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STUDY REPORT
CAA-SR-89-21

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# DESIGN FOR DISCARD (DFD) STUDY

JULY 1989



PREPARED BY
OFFICE OF THE SPECIAL ASSISTANT
FOR MODEL VALIDATION

US ARMY CONCEPTS ANALYSIS AGENCY
8120 WOODMONT AVENUE
BETHESDA, MARYLAND 20814-2797





CAA
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CAA-SR-89-21

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The reason for performing the study was to determine the impact of the Design for Discard (DFD) concept on the Army's current maintenance support force structure. DFD is an Army initiative to reduce materiel maintenance requirements by focusing on discard of system components in lieu of fault isolation and repair, i.e., an effort to identify parts which cost more to repair than to replace. The study addressed those items currently coded for repair which could be candidates for discard, using criteria and an economic methodology developed by the US Army Materiel Systems Analysis Activity (AMSAA). Revised annual maintenance manhours for those items meeting the criteria were applied against the current Manpower Requirements Criteria (MARC). The Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS) Model was the tool used to assess the impact on force structure of the reductions in manhours due to DFD.


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# DESIGN FOR DISCARD (DFD) STUDY

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**DEPARTMENT OF THE ARMY**
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REPLY TO
ATTENTION OF
CSCA-MVD (5-5d)

06 NOV 1989

MEMORANDUM FOR U.S. Army Materiel Command, 5001 Eisenhower Avenue,
ATTN: AMCRE-C, Alexandria, VA 22333-0001

SUBJECT: Design for Discard (DFD) Study

1. Reference:

a. Verbal Request for Analytical Support (CAA Form 233), 31 May 89, subject: Design for Discard (DFD).

b. Memorandum, USACAA, CSCA-MVD, 27 Sep 89, subject: Design for Discard Study for Sponsor Review.

c. Memorandum, AMC, AMCRE-C, 11 Oct 89, subject: Design for Discard Study for Sponsor Review.

2. Reference 1a requested that the U.S. Army Concepts Analysis Agency (CAA) provide an assessment of the impacts of DFD on the Army's force structure at the detail, i.e., Military Occupational Specialty and Table of Organization and Equipment, level.

3. This final report documents the results of our evaluation.

4. This Agency expresses appreciation to all commands and agencies which have contributed to this study. Questions and/or inquiries should be directed to the Office of the Special Assistant for Model Validation, U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797, AUTOVON 295-5225.

E. B. VANDIVER III
Director

| | | |
|---|---|---|
| CAA | **DESIGN FOR DISCARD (DFD) STUDY** | **STUDY SUMMARY CAA-SR-89-21** |

**THE REASON FOR PERFORMING THE STUDY** was to determine the impact of the Design for Discard (DFD) concept on the Army's force structure. DFD is an Army initiative to reduce materiel maintenance requirements by focusing on discard of system components in lieu of fault isolation and repair. It is an effort to identify parts which cost more to repair than to replace. The goal is to design or select system components which are easily diagnosed and isolated upon failure and, if possible, inexpensive enough to throw away at failure. The resultant avoidance of maintenance allows personnel spaces to be realigned or converted to other military occupational specialties (MOSs) and applied against force structure shortfalls.

**THE STUDY SPONSOR** was the US Army Materiel Command (AMC), AMCRE-C.

**THE STUDY OBJECTIVE** was to determine the force structure impact of the DFD concept on current Army maintenance support requirements.

**THE SCOPE OF THE STUDY** was as follows:

**(1)** The DFD Study was based on the Defense Guidance (DG) Illustrative Planning Scenario (IPS) and the 1996 Total Army Analysis (TAA)/Table of Organization and Equipment (TOE) Army.

**(2)** The study focused on the reparable components of 60 major end items which constitute about 60 percent of the total maintenance workload estimated using Manpower Requirements Criteria (MARC) factors. Currently, MARC factors account for only combat mission essential repairs of equipment, not including any associated with combat damage.

**(3)** Only those components with maintenance tasks of repair, test, or overhaul at the direct support (DS) and general support (GS) levels were considered.

**THE MAIN ASSUMPTIONS** of this work are:

**(1)** The sample of major end items used in the study provides a reasonable basis for an estimate of potential force structure savings which accrue from discarding and replacing components due to reliability, availability, and maintainability (RAM) failure in lieu of repair/overhaul of components.

**(2)** The leader MOS concept used in the Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS) Model for determining maintenance unit requirements still applies.

(3) Failure rates of components in wartime will not vary significantly from peacetime experience.

(4) Estimates used in place of missing data elements were reasonable.

**THE BASIC APPROACHES** used in this study were to:

(1) Include those systems encompassing 60 percent of the DS and GS maintenance workload.

(2) Focus on the component parts of these end items which are currently coded for repair but could become candidates for discard.

(3) Compare these items against criteria developed by the US Army Materiel Systems Analysis Activity (AMSAA).

(4) Apply reductions in workload factors for items meeting the criteria, using the FASTALS Model to determine potential force structure savings. Identify the savings, if any, in terms of military spaces by MOS and standard requirement code (SRC).

**THE PRINCIPAL FINDINGS** of the work reported herein are as follows:

(1) Many components of major end items could be reclassified as discardable items based on the economic methodology used in the study.

(2) Force structure savings based on the labor savings achieved through the use of the DFD concept and applied through the study methodology were negligible.

(3) Further study should be undertaken by the US Army Training and Doctrine Command (TRADOC), possibly to include replacement (versus repair) of components due to combat damage. No significant savings in force structure will be realized through the use of the DFD concept unless the Army's maintenance structure is realigned. Changes in unit design and allocation rules are necessary for the DFD concept to prove effective in reducing required force structure.

**THE STUDY EFFORT** was directed by Ms. Julianne Allison, CSCA-MVD, 295-5225.

**COMMENTS AND QUESTIONS** may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-MV, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

*Tear-out copies of this synopsis are at back cover.*

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# DESIGN FOR DISCARD (DFD) STUDY

## CHAPTER 1

## INTRODUCTION

### 1-1. BACKGROUND

**a. Design for Discard (DFD) Concept.** Design for Discard (DFD) is an Army initiative to reduce materiel maintenance requirements by focusing on discard of system components in lieu of fault isolation and repair, i.e., an effort to identify parts which cost more to repair than to replace over the life cycle of the system. The goal is to design or select system components which are easily diagnosed and isolated upon failure and, if possible, inexpensive enough to throw away at failure. The resultant avoidance of maintenance would allow personnel spaces to be realigned or converted to other military occupational specialties (MOSs) and applied against force structure shortfalls.

**b. Previous DFD Studies.** During 1987 and 1988, two macrolevel studies were conducted to examine the DFD concept and its possible implications. In 1987, the Inventory Research Office (IRO) of the US Army Materiel Systems Analysis Activity (AMSAA) completed a study entitled "Approximate Procedures to Reevaluate Reparable Items' Costs for the Option Throwaway (The APRICOT Analysis)." The study looked at the Army's catalog of current reparable components for fielded end items to assess the impact of a DFD environment on the current maintenance of items. The repair versus throwaway costs were compared for items in the reparable catalogs. Estimated failure rates and average manhours and cost data were used. The findings showed potentially significant savings in the form of dollars and manpower could be achieved by implementation of the concept. However, further study was recommended to identify these savings at a more detailed level. Army Materiel Command (AMC) commanding officers, after being briefed, requested analysis of specific systems. A follow-on study was conducted in 1988 which focused on two major end items, the M109 howitzer and the M939 truck series. Again, the potential manpower and dollar savings estimated in this study that would result from reclassifying existing reparable components as throwaway for the two end items studied were found to be significant. It was then recommended that a microlevel study be conducted to determine the impact of DFD on the Army's force structure.

### 1-2. DFD STUDY

**a. Tasking.** The US Army Concepts Analysis Agency (CAA) was tasked by AMC to conduct the recommended detail-level study. The DFD Study was planned to be incorporated as an excursion to the Support Force Requirements Analysis Study - 1996 (SRA-96), CAA's part of the Total Army Analysis - 1996 (TAA-96) process. The study would include the top maintenance workload generators, i.e., those systems encompassing 50 percent of the direct support (DS) and general support (GS) maintenance workload. The list of systems was expanded to include those making up 60 percent of DS and GS maintenance. This was

done to allow for potential data problems and/or lack of data so that the systems actually studied would make up at least 50 percent of the maintenance workload. Component parts of these end items which are currently coded for repair but could become candidates for discard were the subject of the study. These items were to be compared against criteria developed by AMSAA. For items meeting the criteria, reductions in workload factors were to be applied using the Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS) Model to determine potential force structure savings. The savings, if any, were to be identified in terms of military spaces (by MOS) and standard requirement code (SRC). These spaces could then be applied toward other combat service support (CSS) functions or combat/combat support (CS) spaces.

**b. Purpose** The purpose of the DFD Study was to determine the impact of the DFD concept on the Army's force structure.

**c. Scope.** The DFD Study was based on the Defense Guidance (DG) Illustrative Planning Scenario (IPS) and the 1996 TAA/Table of Organization and Equipment (TOE) Army. The study focused on the reparable components of 60 major end items which constitute a large percentage (about 60 percent) of the total maintenance workload. Currently, MARC factors account for only combat mission essential repairs of equipment, not including any associated with combat damage. Only those components with maintenance tasks of repair, test, or overhaul at the DS and GS levels were considered. (This is explained in Chapter 3.) An economic criteria, projected lifetime replacement cost (PLRC), was used to determine which items were candidates for replacement rather than repair.

**d. Essential Elements of Analysis (EEA).** The EEA of the study were to:

**(1)** Identify existing reparable components for possible reclassification as throwaway components.

**(2)** Identify military spaces by MOS and SRC which could be realigned or converted to other MOSs.

**(3)** Determine the impact on the Army force structure of the DFD concept within the limits of the scope of this study.

The answers to these EEA, as determined in the DFD Study, are addressed in Chapter 4, Results and Analysis.

**e. Assumptions.** The assumptions applicable to the DFD Study were as follows:

**(1)** The sample of major end items used in the study provides a reasonable basis for an estimate of potential force structure savings which accrue from discarding and replacing components due to reliability, availability, and maintainability (RAM) failure in lieu of repair/overhaul of components.

**(2)** The leader MOS concept used in FASTALS for determining maintenance unit requirements still applies.

**(3)** Failure rates of components in wartime will not vary significantly from peacetime experience.

**(4)** Estimates used in place of missing data elements were reasonable (these estimates are described in Chapter 2, paragraph 2-5, Data Limitations).

**1-3. CONTENTS OF THE REPORT.** This chapter has provided the introductory information applicable to the DFD Study. Following chapters contain more detailed information concerning the data, methodology, and results of the study.

# CHAPTER 2

# DATA

**2-1. DATA REQUEST.** In June of 1988, AMC put out a data call for the DFD Study. The data request specified the required data elements and included record format specifications for data on 60 major end items by line item number (LIN). Each of AMC's major subordinate commands (MSCs) was required to provide the requested information for all reparable components by national stock number (NSN) of each end item managed by their command. The data was to be provided in dBase III compatible floppy disk files. The suspense date for submission of the data was 1 August 1988.

**2-2. DATA PROBLEMS.** Several problems were encountered with both the submission of data and the data itself. There were extensive delays in obtaining the data. The effort was not completed until February 1989. This forced the study to be separated from the SRA-96 Study, which it had originally been planned to supplement as an excursion. The DFD Study was then temporarily put on hold until March of 1989. When the study was resumed, several data problems were discovered. First, for some end items, no data was provided at all. Secondly, much of the data that was provided was not in the requested form. Most of it was provided on floppy disks as requested, but much of it was not in dBase III file format. Those that were not were either "flat" files (ASCII format) or in LOTUS 1-2-3 file format. The data not provided on floppy disk were either in hard copy form or on tape. Thirdly, some of the data was not in the required data format, e.g., data elements were not in the required fields, decimal formats were incorrect, etc. Lastly, there were many problems with missing or incomplete data elements. Many of these problems were resolved through phone calls, file conversion, and manipulation of the data files and the data, but some could not be resolved. Estimates were made for some of the data elements that remained incomplete. The resolution of these problems caused more delays in conducting the study. Actual FASTALS production runs for the DFD Study began in May 1989.

**2-3. END ITEMS.** At the outset of the DFD Study, it was decided that focusing on a small number of systems would not accomplish the study objectives. It was also not feasible to study all end items with reparable components, so a way of choosing the systems to be studied had to be determined. The total maintenance workload was used as the criteria for choosing the systems to be studied. The top 60 workload generators (out of a total of 2,135), which comprise 60 percent of the total DS and GS maintenance workload, were chosen. The end items studied and their associated LINs are listed in Table 2-1, along with the MSC responsible for management of each item.

Table 2-1. End Items
(page 1 of 2 pages)

| LIN | LIN nomenclature | MSC |
|---|---|---|
| C10908 | CARRIER CARGO: TRACKED AMMO MEDIUM 7-TON | TACOM |
| C12155 | CARRIER PERSONNEL FULL TRACKED: ARMORED FIRE SPT | TACOM |
| C76335 | CAVALRY FIGHTING VEHICLE: M3 | TACOM/ AMCCOM |
| D11049 | CARRIER CARGO: TRACKED 6-TON | TACOM |
| D11538 | CARRIER COMMAND POST: LIGHT TRACKED | TACOM |
| D12087 | CARRIER PERSONNEL FULL TRACKED: ARMORED | TACOM |
| E00533 | CHARGER RADIAC DETECTOR: PP-1578/PD | CECOM |
| E56896 | COMBAT VEHICLE ANTITANK: IMPROVED TOW VEH (W/O TOW WPN) | TACOM |
| E70064 | COMP UNIT RCP: TRK 2 WHL PNEU TIRES GAS DRVN 5 CFN 175 PSI | TACOM |
| H02300 | ELECTRONIC TELETYPEWRITER SECURITY EQUIPMENT: ISEC/KW-7 | CECOM |
| J35813 | GEN ST DSL ENG: 5KW 60HZ 1-3PH AC 120/208 120/240V TAC UTIL | TACOM |
| J35825 | GEN ST DSL ENG: 10KW 60HZ 1-3PH AC 120/208 120/240V TAC UTIL | TACOM |
| J42100 | GEN ST GAS ENG TM: 10KW 60HZ 1-3PH AC 120/240 120/208V PU-619/ | TACOM |
| J43918 | GEN ST GAS ENG: 1.5KW 60HZ 1PH 2 WIRE AC 120V SHOCK TAC UTIL | TACOM |
| J44055 | GEN ST GAS ENG: 1.5KW DC 28V SHOCK TAC UTIL | TACOM |
| J45699 | GEN ST GAS ENG: 3KW 60HZ 1-3PH 120/240 120/208V SKD TAC UTIL | TACOM |
| J46110 | GEN ST GAS ENG: 3KW DC 28V SKD-SHK TBLR FRAME MTD TAC UTIL | TACOM |
| J47617 | GEN ST GAS ENG TM: 5KW 60HZ 2EA MTD ON M116 PU-260 | TACOM |
| J81750 | INFANTRY FIGHTING VEHICLE | TACOM/ AMCCOM |
| J95533 | GUIDED MISSILE SYSTEM INTERCEPT AERIAL CARRIER MTD: (CHAP) | MICOM |
| K29694 | HEL ATTACK: TOW MISSILE | AVSCOM |
| K31042 | HEL OBSERVATION: OH-58A | AVSCOM |
| K31795 | HEL UTILITY: UH-1H | AVSCOM |
| K32293 | HEL UTILITY: UH-60A | AVSCOM |
| K56981 | HOWITZER HVY SELF-PROPELLED: 8 INCH | AMCCOM |
| K57667 | HOWITZER MED SELF-PROPELLED: 155 MM | AMCCOM |
| P45003 | POWER UNIT UTIL PACK: GAS TURBINE ENG DRVN (MUST) | TACOM |
| Q90100 | RADIO TELETYPEWRITER SET: AN/GRC-122 | CECOM |
| Q90120 | RADIO TELETYPEWRITER SET: AN/GRC-142 | CECOM |
| R50544 | RECOVERY VEH FULL TRACKED: LT ARMORED | AMCCOM |
| R50681 | RECOVERY VEHICLE FULL TRACKED: MEDIUM | TACOM |
| R94977 | RIFLE 5.56MM: M16A1 | AMCCOM |
| T05028 | TRUCK UTIL: TACTICAL 3/4 TON W/E M1009 | TACOM |

Table 2-1. End Items
(page 2 of 2 pages)

| LIN | LIN nomenclature | MSC |
|---|---|---|
| T07543 | TRUCK UTIL: S250 SHELTER CARRIER 4X4 W/E (HMMWV) | TACOM |
| T10138 | SHOP EQUIP CONTACT MAINT TRK MTD | AMCCOM |
| T13168 | TANK COMBAT FULL TRACKED: 120MM GUN | TACOM |
| T13169 | TANK COMBAT FULL TRACKED: 105MM GUN (TTS) | TACOM |
| T13374 | TANK COMBAT FULL TRACKED: 105MM M1 (ABRAMS) | TACOM |
| T34437 | TRACTOR WHEELED: DSL 4X4 W/EXCAVATOR AND FRONT LOADER | TACOM |
| T49119 | TRUCK LIFT FORK: DSL DRVN 10000 LB CAP0 48-IN LD CTR ROUGH TERRAIN | TACOM |
| T49255 | TRUCK LIFT FORK: DSL DRVN 4000LB CAP ROUGH TERRAIN | TACOM |
| T59346 | TRUCK CARGO: TACT 5/4 TON 4X4 W/COMMO KIT | TACOM |
| T59482 | TRUCK CARGO: TACT 5/4 TON 4X4 W/E M1008 | TACOM |
| T61494 | TRUCK UTIL: CARGO/TROOP CARRIER 1-1/4-TOW 4X4 W/E (HMMWV) | TACOM |
| T92242 | TRUCK UTIL: ARMT CARRIER ARMD 1-1/4-TON 4X4 W/E (HMMWV) | TACOM |
| V12141 | TANK & PUMP UNIT LIQ DISPENSING TRUCK MOUNTING | TACOM |
| V31211 | TELEPHONE SET: TA-312/PT | CECOM |
| W76473 | TRACTOR FULL TRACKED HIGH SPEED: ARMORED COMBAT EARTHMOVER | TACOM |
| W95537 | TRAILER CARGO: 3/4 -TON 2 WHEEL W/E | TACOM |
| W95811 | TRAILER CARGO: 1-1/2-TON 2 WHEEL W/E | TACOM |
| X23277 | TRANSPORTER BRIDGE FLOATING | TACOM |
| X40009 | TRUCK CARGO: 2-1/2-TON 6X6 W/E | TACOM |
| X40146 | TRUCK CARGO: 2-1/2-TON 6X6 W/WINCH W/E | TACOM |
| X40794 | TRUCK CARGO: DROP SIDE 5 TON 6X6 W/E | TACOM |
| X40831 | TRUCK CARGO: 5 TON 6X6 LWB W/E | TACOM |
| X43708 | TRUCK DUMP: 5-TON 6X6 W/E | TACOM |
| X44403 | TRUCK DUMP: 20-TON DSL DRVN 12 CU YD CAP (CCE) | TACOM |
| X59326 | TRUCK TRACTOR: 5-TON 6X6 W/E | TACOM |
| X60833 | TRUCK UTILITY: 1/4-TON 4X4 W/E | TACOM |
| X63299 | TRUCK WRECKER: 5-TON 6X6 W/WINCH WE | TACOM |

**2-4. DATA ELEMENTS.** Three types of data records were required for each end item. The following paragraphs discuss each record type and its data elements.

**a. Task Record.** The first record type was the task record. Table 2-2 specifies the data elements included in each task record.

**Table 2-2. Task Record Data Elements**

| Data element descriptor | Data element |
|---|---|
| LIN | Line item number of end item |
| NSN | National stock number of reparable component |
| TASK | Maintenance task performed on component: repair, replace, overhaul, test, adjust |
| ECH | Echelon at which task performed: ORG, IDS, IGS, DEP |
| MOS | Primary military occupational specialty code for task |
| HRM | Manhours to perform task |
| NUMP | Number of people required on task |
| IDEF | Deferability of task: immediately (IMM), 1st opportunity (FOP), indefinite (IND) |

**b. End Item Record.** Table 2-3 lists the data elements in the end item record.

**Table 2-3. End Item Record Data Elements**

| Data element descriptor | Data element |
|---|---|
| LIN | Line item number of end item |
| NAME | Nomenclature of end item |
| DENS | Total density of all end items in LIN averaged to a per-year basis over projected lifetime |
| YRS | Projected number of years remaining in life of end item |
| PCD | Program code: M = mileage, R = rounds, H = hours, F = flying hours |
| PROG | Projected average yearly usage program for all end items in LIN |
| BASE | Base usage program upon which failure factors are computed for all end items in LIN |

c. **NSN Record.** Within each LIN, there were several NSNs. The NSN record includes all data elements associated with each of the NSNs for one LIN. The data elements are listed in Table 2-4.

**Table 2-4. NSN Record Data Elements**

| Data element descriptor | Data element |
|---|---|
| NSN | National stock number of reparable component |
| NAME | Nomenclature of reparable component |
| FF1 | Failure factor for peacetime usage |
| FF2 | Failure factor for wartime usage |
| PCD | Program code: M = miles traveled, R = rounds fired, H = hours operated, F = flying hours |
| UP | Unit price |
| WGT | Weight (pounds) |
| CUBE | Volume (cubic feet) |
| MTD ORG | Maintenance task distribution - organizational: percentage of repair of this component conducted at ORG level |
| MTD IDS | Maintenance task distribution - intermediate direct support: percentage of repair of this component conducted at IDS level |
| MTD IGS | Maintenance task distribution - intermediate general support: percentage of repair of this component conducted at IGS level |
| MTD DEP | Maintenance task distribution - depot: percentage of repair of this component conducted at DEP level |
| REPR | Replacement factor - percentage of removal components which cannot be repaired |
| FGC | Functional group code assigned to group of NSNs to which this component belongs for purposes of MARC taskings |
| SMR | Source, maintenance, and recoverability code |

Note: from this point on in this report, the data element descriptors shown in the first column of Tables 2-2 through 2-4, rather than the entire data element name, will be used to refer to each data element.

## 2-5. DATA LIMITATIONS

**a. Reduction in Number of End Items Studied.** As mentioned in paragraph 2-2, some data problems were encountered at the outset of the DFD Study which could not be resolved. Data was incomplete or unusable for 14 end items. Therefore, the original list of 60 end items to be studied (which make up 60 percent of the total maintenance workload) had to be reduced to 46. Those 46 items constitute 48 percent of the total workload. Although this did not quite meet the goal of studying systems that make up 50 percent of the workload, it was very close. The 14 end items that had to be dropped from the study were those shown in Table 2-5.

Table 2-5. End Items Dropped from Study

| LIN | LIN nomenclature |
|---|---|
| E00533 | CHARGER RADIAC DETECTOR: PP-1578/PD |
| H02300 | ELECTRONIC TELETYPEWRITER SECURITY EQUIPMENT: ISEC/KW-7 |
| J95533 | GUIDED MISSILE SYSTEM INTERCEPT AERIAL CARRIER MTD: (CHAP) |
| Q90100 | RADIO TELETYPEWRITER SET: AN/GRC-122 |
| Q90120 | RADIO TELETYPEWRITER SET: AN/GRC-142 |
| R50681 | RECOVERY VEHICLE FULL TRACKED: MEDIUM |
| T10138 | SHOP EQUIP CONTACT MAINT TRK MTD: |
| T34437 | TRACTOR WHEELED: DSL 4X4 W/EXCAVATOR AND FRONT LOADER |
| T49119 | TRUCK LIFT FORK: DSL DRVN 10000 LB CAP0 48IN LD CTR ROUGH TERRAIN |
| V31211 | TELEPHONE SET: TA-312/PT |
| W76473 | TRACTOR FULL TRACKED HIGH SPEED: ARMORED COMBAT EARTHMOVER |
| W95537 | TRAILER CARGO: 3/4 TON 2 WHEEL W/E |
| W95811 | TRAILER CARGO: 1-1/2 TON 2 WHEEL W/E |
| X60833 | TRUCK UTILITY: 1/4 TON 4X4 W/E |

**b. Data Estimates.** It was stated in paragraph 2-2 that some data elements were missing or questionable and had to be estimated. The following paragraphs specify these elements and explain the estimates used.

**(1) Data Element BASE.** In almost all of the data files, the data element BASE was either missing or equal to the PROG element. Since this problem was so prevalent, all missing BASE elements were also set equal to their corresponding PROG elements. This effectively eliminated the use of these elements in the study because they were to be used in a formula where PROG is divided by BASE and the result multiplied by other data elements. The result of the division would always be equal to one and the calculation would have no effect on the result of the formula.

(2) **Data Element YRS.** The data element YRS was missing in several data files. In these cases, an estimate of 20 years was used.

(3) **Data Element PCD.** In a majority of the data files, the element PCD was either missing or the same throughout the file. It was decided that this data was not useful as it was and that it was not feasible to try to recollect the data. Therefore, this data element was not used in the study.

c. **Data Elements Not Used.** There were several data elements that were included in the data call which did not enter directly into study calculations or analysis. Many of these elements were used implicitly, as they were inherent in other elements. For example, NUMP is implicitly a part of the HRM. Also, the FASTALS methodology and associated workloads provided a means of estimating the impact of DFD without the need for some of the requested elements. The items not used explicitly in the study were the following: NUMP, IDEF, FF2, WGT, CUBE, MTD ORG, MTD IDS, MTD IGS, MTD DEP, REPR, FGC, and SMR.

# CHAPTER 3

# METHODOLOGY

**3-1. TWO-PART METHODOLOGY.** There were two major parts to the methodology used in the DFD Study. The first part, which will be referred to as the economic methodology, involved the calculations required to determine whether a component of an end item met the criteria to become a discardable item. The second part of the methodology was the force structure methodology. This involved the use of the FASTALS Model to assess the potential savings in force structure due to the DFD concept. Both methodologies are discussed in detail in this chapter.

## 3-2. ECONOMIC METHODOLOGY

**a. Data Processing.** The first step in the study was to reconcile the data. Since the data arrived in various file formats, one had to be chosen as the preferred format. LOTUS 1-2-3 was chosen, and all data that was not already in LOTUS 1-2-3 format was converted. When this was finished, there existed three LOTUS files for each end item (LIN): a task file, an end item file, and an NSN file. These three files were aggregated for each LIN. This was done by simply combining the end item file and the NSN file and then matching on NSN to incorporate the task file (the NSN appeared in both the NSN file and the task file). The next step was to reduce the number of NSNs to be considered as throwaway candidates by checking them against certain criteria.

**b. Echelon and Task Criteria.** The first criteria against which each component was checked was the echelon criteria. Only those components whose tasks are performed at either the DS or GS echelon were used, since FASTALS does not directly consider maintenance tasks to be performed at organizational or depot levels. Components meeting this test were then checked for the types of tasks to be performed on them. Those with tasks of repair, test, or overhaul were chosen. The next step was to calculate the projected lifetime replacement cost (PLRC) for each LIN/NSN combination. This calculation is the subject of the following paragraph.

**c. PLRC Calculation.** The first part of the PLRC calculation is the computation of projected lifetime failures (PLF). The formula used to compute PLF is as follows (using the data element descriptors that appeared in Tables 2-2 through 2-4):

$$PLF = FF1 * (PROG/BASE) * (DENSITY/100) * YRS$$

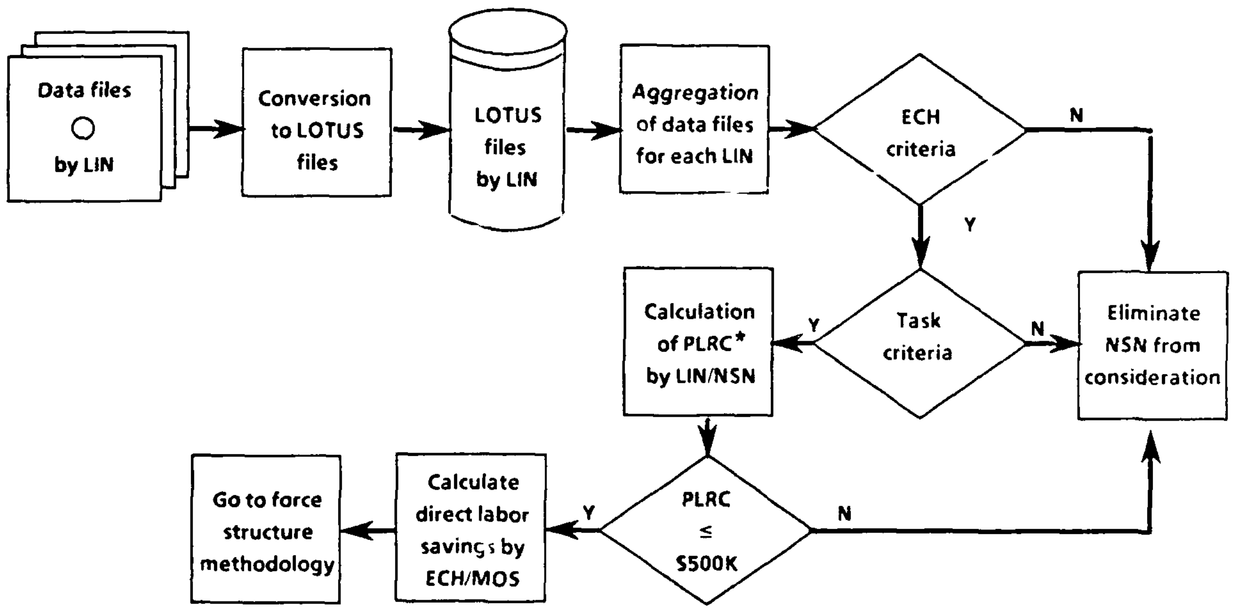
(In this formula, the PROG/BASE portion of the equation was effectively eliminated from the calculation because it was always equal to 1, as explained in paragraph 2-5a.) To determine the PLRC, the PLF is then multiplied by the unit price (UP):

$$PLRC = PLF * UP$$

These formulas were provided to CAA for the DFD Study by IRO.

d. **Economic Criteria.** The PLRC is the criteria used to separate reparable components into potential discard candidates and those with prohibitive costs which would remain reparable items. IRO provided a cutoff point of $500,000 to be used as the factor to make this determination. The PLRC for each LIN/NSN pair was computed and checked to see if it was either less than or equal to $500,000 or above $500,000. Those above were no longer considered as throwaway candidates. Those below or equal to $500,000 went on to the next step in the process. (The sensitivity of the results to the $500,000 cutoff was examined, as described in paragraph 3-4.)

e. **Calculation of Labor Savings.** Labor savings were computed for all components meeting each of the criteria discussed above. This was done by summing the HRM (manhours to perform task) over all components for each end item by ECH (echelon) and MOS. This was the last step in the economic portion of the methodology. A summary of the economic methodology is shown in Figure 3-1, and an example is provided in the next paragraph. The second part of the DFD study methodology, the force structure methodology, is discussed in paragraph 3-3.




*PLRC = projected lifetime replacement cost

Figure 3-1. Economic Methodology

**f. Example**

**(1)** An example using a typical end item is discussed in this paragraph to illustrate the methodology to this point. The end item chosen for the example was the M1A1 tank, LIN T13374. The data provided for this end item included 248 NSNs (reparable components). Of the 248, there were 111 with tasks to be performed in the DS and GS echelons. When checked against the task criteria, the number of NSNs decreased to 99, i.e., 99 NSNs had tasks of repair, test, or overhaul. The PLRC for each of these 99 NSNs was then calculated and matched against the $500,000 economic criteria. The result of this check reduced to 30 the number of NSNs to be considered as throwaway candidates. For these remaining 30 NSNs, the reduction in maintenance manhours (labor savings) by ECH and MOS was calculated. The results per tank per year were as shown in Table 3-1.

**Table 3-1. M1A1 Tank Example**

| Echelon | MOS | MOS name | Labor savings (manhours) |
|---|---|---|---|
| DS | 45G<br>45K | Fire Control Systems Repairer<br>Tank Turret Repairer | 55.2<br>5.1 |
| GS | 45K | Tank Turret Repairer | 3.8 |
| Total | | | 64.1 |

**(2)** The labor savings of 64.1 manhours were subtracted from the original manhours required to perform the relevant tasks. The original requirement was for 895.8 manhours at the DS and GS levels for MOSs 45G and 45K. This total was reduced to 831.7 with the savings in manhours due to DFD. This represents a decrease in annual maintenance effort per tank of 7.2 percent. The labor savings achieved for each of the 46 end items studied were applied in the second phase of the methodology, the force structure methodology.

**3-3. FORCE STRUCTURE METHODOLOGY.** The FASTALS Model was the tool used in the DFD Study to assess the impact of the DFD concept on the Army's force structure. An overview of the FASTALS Model is provided in the following subparagraphs as an introduction to the force structure methodology used in the DFD Study. A more detailed description of FASTALS is provided in Appendix D.

**a. FASTALS Overview**

**(1) Introduction.** The FASTALS Model is a tool used by CAA to compute the logistics workloads for planning theater support unit requirements in a relatively short period of time. It is primarily used in force planning analyses where balanced, time-phased, geographically distributed force requirements are desired. Given a tactical situation, logistics capabilities, and theater policies, FASTALS can be used to determine the total force necessary to support the situation logistically. The FASTALS Model has been

used extensively in the preparation of input for the Army Program Objective Memorandum (POM), the Army contribution to the Joint Strategic Planning Document (JSPD) analyses and many other studies. The results produced have achieved wide acceptance throughout the Army Staff.

**(2) Background.** FASTALS was developed in 1971 by the Research Analysis Corporation (RAC) as part of a large system of models known as the Forces and Weapons (FOREWON) System. As used in a typical study, FASTALS is part of a system of integrated models. Given specific scenario and defined force, the Transportation Model (TRANSMO) computes deployment schedules, based on movement requirements in terms of tonnage, cargo types, and available transport. The warfighting model then computes the combat results based on a supplied scenario and TRANSMO's force movement schedule. FASTALS, using the warfighting results, a scenario, and a master file of available units, computes the support force requirements necessary to round out the combat force. The scenario and master files are the primary input files to FASTALS. FASTALS output is compared to the original force definition in a matching process to check the availability of the roundout force. FASTALS outputs are further analyzed (depending on the particular study) by a system of postprocessors.

**(3) General Model Description.** The purpose of the FASTALS Model is to compute administrative and logistical workloads and to generate the theater-level support force structure requirements necessary to round out a combat force in a postulated confrontation. The trooplist produced by FASTALS is said to be balanced when the individual units comprising the list are capable of accomplishing the various workloads generated by the total force. Trooplists are said to be time-phased when unit requirements are prescribed for each time period in the simulation. Support to combat units is defined as the logistical and administrative service support necessary to support a tactical activity. The major elements of support are maintenance, construction, supply, transportation, hospitalization and evacuation, and personnel replacement. Requirements for units performing these functions are derived from workloads which are generated as a function of the combat force deployment, theater structure, and the tactical operations as developed in the campaign simulation model.

**b. FASTALS in Force Structure Methodology.** In the DFD Study, FASTALS was used to determine the change in force structure by theater in the DG IPS due to DFD. The methodology used to do this is described in the following paragraphs.

**(1) Application of Labor Savings.** The labor savings (totals by ECH and MOS for each end item), which were calculated in the economic methodology, were subtracted from the corresponding ECH and MOS in the MARC file to reflect the reduction in maintenance workload due to DFD for each end item studied. The MAPC file was then used as an input file to a FASTALS Model run to determine the savings in force structure attributable to the reduced maintenance manhours. The FASTALS process, which makes up the remainder of the force structure methodology, is discussed in the next paragraph.

(2) **FASTALS Runs.** Two FASTALS runs were used in the second step of the force structure methodology. The basic procedure used was to compare the output from a base run of the FASTALS Model with the results of a second run which used as input the reduced MARC maintenance workload file produced in the first step of the force structure methodology. (All other inputs remained the same.) The base run used was the SRA-96 design case, which was based on the DG IPS and the 1996 TAA/TOE Army. The output of primary interest from these two runs was a comparison between the two which shows the difference in personnel strength required, i.e., the potential change in force structure. This comparison is broken down by theater (North Atlantic Treaty Organization (NATO), Southwest Asia (SWA), and Northeast Asia (NEA)) and SRC. (The original runs and the resultant comparison will be referred to as the base case set of runs from this point on in this report.) After these runs were completed, the FASTALS results were analyzed. Results are discussed in Chapter 4. A summary of the DFD force structure methodology is shown in Figure 3-2.

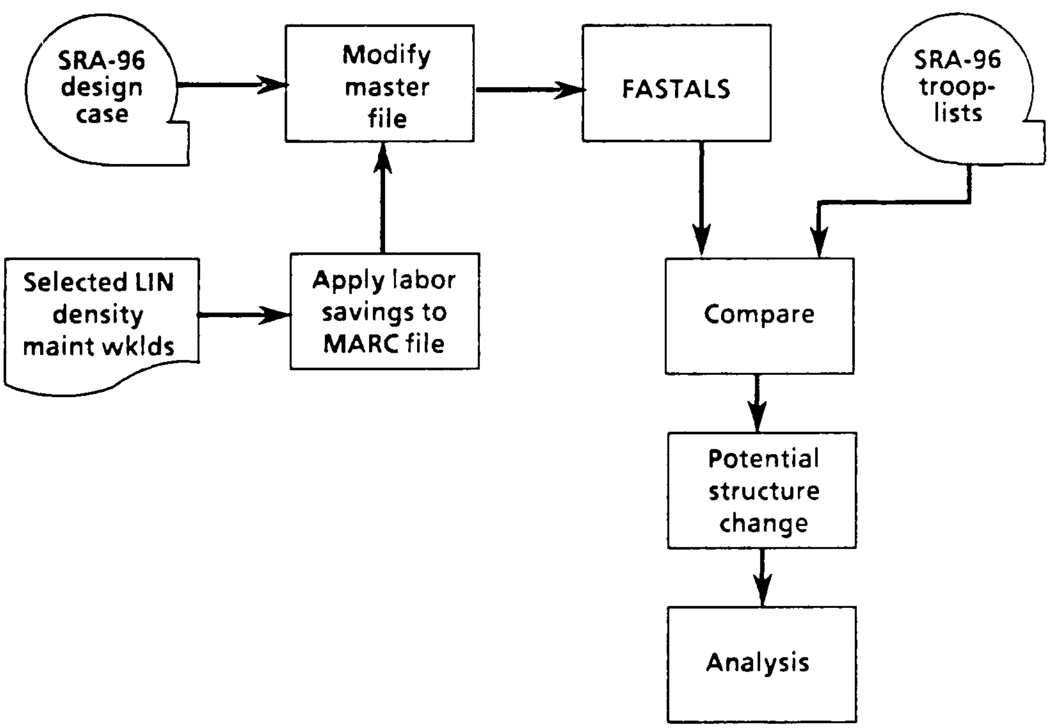



Figure 3-2. Force Structure Methodology

**3-4. SENSITIVITY ANALYSIS.** After the initial base case FASTALS runs were complete, several others were done. The initial runs were unconstrained, i.e., true unit requirements as generated by FASTALS were used in the runs. In other words, FASTALS in the unconstrained mode builds support to component code (COMPO) 4 units. In a constrained run, COMPO 4 units are not supported; total unit requirements are limited by a maximum quantity for each SRC in the master file. A second set of base case runs (by NATO, SWA, and NEA theater) was conducted in the constrained mode. Then, in order to test the sensitivity of the results to the economic criteria used ($500,000 cutoff), four more sets of runs were conducted. A constrained and an unconstrained run (each including all three theaters) were done using $250,000 as the criteria, or one-half of the original $50C,000 criteria. This set of runs will be called the first excursion. The second excursion constituted the last set of runs (constrained and unconstrained, all three theaters in each), which was done using twice the original economic criteria, or $1 million. The results of all of these runs were analyzed in terms of their impact on the original (base case) study results. The next chapter contains the results of each set of runs and the analysis of the results.

# CHAPTER 4

# RESULTS AND ANALYSIS

**4-1. INTRODUCTION.** In this chapter, the results of the DFD base case runs will be discussed first, followed by the results of all sensitivity runs.

**4-2. LABOR SAVINGS.** The last step in the economic methodology was to compute labor savings in terms of annual maintenance manhours by LIN, ECH, and MOS. These decrements in manhours, which were applied through the use of the FASTALS Model, were the drivers for any force structure savings to be realized. Table 4-1 shows the labor savings derived for each major end item studied. The savings are presented in LIN/ECH/MOS sequence. The original maintenance manhours (from the MARC file) required for each LIN are shown in the next to last column of the table, and the reductions in manhours from the original requirement are listed in the last column. (The numbers shown are annual savings per item.) For some major end items, there were no labor savings. Those items are not listed in the table.

**4-3. RESULTS OF BASE CASE RUNS.** Table 4-2 presents the study results based on the labor savings shown in Table 4-1. These are the results of the original unconstrained FASTALS runs based on the economic criteria of $500,000. The results are presented by theater in terms of the change in force structure between the two base case runs. The SRCs which dropped out due to the savings attained by using the DFD concept are listed along with a short description of each. As Table 4-2 indicates, only maintenance units were affected. The impact of the labor savings was not large enough to affect any other area, such as medical, supply, etc. The NATO theater realized the greatest impact. The effects in the SWA and NEA theaters were small, with only one unit being saved in NEA and none in SWA.

Table 4-1. Labor Savings - Annual Maintenance Manhours
(page 1 of 2 pages)

| LIN[a] | ECH | MOS | MOS name | Original manhours | Manhours subtracted |
|---|---|---|---|---|---|
| C10908 | DS | 63H | Track vehicle repairer | 556.6 | 108.2 |
| C12155 | DS | 63H | Track vehicle repairer | 200.9 | 9.9 |
| C76335 | DS | 45K | Tank turret repairer | 85.8 | 83.0 |
| | | 63G | Fuel & elec sys repairer | 220.4 | 5.0 |
| D11049 | DS | 63H | Track vehicle repairer | 279.0 | 2.7 |
| D11538 | DS | 63H | Track vehicle repairer | 201.0 | 0.6 |
| E56896 | DS | 63H | Track vehicle repairer | 200.2 | 2.6 |
| J35813 | DS | 52D | Power generation equip repairer | 140.0 | 2.0 |
| | GS | 52D | Power generation equip repairer | 73.2 | 1.3 |
| J35825 | DS | 52D | Power generation equip repairer | 147.0 | 7.4 |
| | GS | 52D | Power generation equip repairer | 85.4 | 2.0 |
| J42100 | DS | 52D | Power generation equip repairer | 260.4 | 5.2 |
| | GS | 52D | Power generation equip repairer | 146.4 | 19.8 |
| J43918 | DS | 52D | Power generation equip repairer | 72.8 | 1.1 |
| J44055 | DS | 52D | Power generation equip repairer | 72.8 | 3.0 |
| J45699 | DS | 52D | Power generation equip repairer | 84.0 | 7.1 |
| J46110 | DS | 52D | Power generation equip repairer | 161.0 | 7.1 |
| J47617 | DS | 52D | Power generation equip repairer | 224.0 | 4.6 |
| | GS | 52D | Power generation equip repairer | 146.4 | 4.8 |
| J81750 | DS | 45K | Tank turret repairer | 85.8 | 80.3 |
| K29694 | DS | 68F | Aircraft electrician | 65.8 | 8.5 |
| | | 68G | Aircraft structural repairer | 109.2 | 17.8 |
| | | 68H | Aircraft pneudraulics repairer | 22.4 | 12.9 |
| | | 68J | Aircraft fire control repairer | 1455.9 | 11.8 |
| K31042 | DS | 35M | Avionic navigational & flight control equip repairer | 91.0 | 6.3 |
| K32293 | DS | 35R | Avionic special equip repairer | 147.6 | 8.1 |
| K56981 | DS | 45L | Artillery repairer | 492.8 | 13.4 |
| K57667 | DS | 45L | Artillery repairer | 588.0 | 143.4 |
| | GS | 45L | Artillery repairer | 223.0 | 95.5 |

Table 4-1. Labor Savings - Annual Maintenance Manhours
(page 2 of 2 pages)

| LIN[a] | ECH | MOS | MOS name | Original manhours | Manhours subtracted |
|---|---|---|---|---|---|
| P45003 | DS | 52F | Turbine eng drvn generator repairer | 511.0 | 53.4 |
| | GS | 52F | Turbine eng drvn generator repairer | 162.5 | 22.5 |
| R50544 | DS | 44B | Metal worker | 3.5 | 3.5 |
| T05028 | DS | 63W | Wheel vehicle repairer | 71.0 | 3.3 |
| T07543 | DS | 63W | Wheel vehicle repairer | 71.0 | 14.7 |
| | GS | 63W | Wheel vehicle repairer | 47.1 | 21.6 |
| T13168 | DS | 41C | Fire control instrument repairer | 68.6 | 0.7 |
| | | 45G | Fire control systems repairer | 137.8 | 5.2 |
| | | 45K | Tank turret repairer | 476.0 | 33.6 |
| | GS | 45K | Tank turret repairer | 322.0 | 2.8 |
| T13169 | DS | 45K | Tank turret repairer | 476.0 | 15.6 |
| | GS | 45K | Tank turret repairer | 244.0 | 3.7 |
| T13374 | DS | 45G | Fire control systems repairer | 137.8 | 5.1 |
| | | 45K | Tank turret repairer | 477.0 | 55.2 |
| | GS | 45K | Tank turret repairer | 281.0 | 3.8 |
| T49255 | DS | 63W | Wheel vehicle repairer | 319.1 | 10.3 |
| | GS | 63W | Wheel vehicle repairer | 299.0 | 12.0 |
| T59346 | DS | 63W | Wheel vehicle repairer | 71.0 | 0.3 |
| | GS | 63W | Wheel vehicle repairer | 54.0 | 0.4 |
| T59482 | DS | 63W | Wheel vehicle repairer | 71.0 | 0.3 |
| T61494 | DS | 63W | Wheel vehicle repairer | 71.0 | 2.5 |
| | GS | 63W | Wheel vehicle repairer | 54.0 | 1.6 |
| T92242 | DS | 63W | Wheel vehicle repairer | 71.0 | 9.2 |
| | GS | 63W | Wheel vehicle repairer | 54.0 | 11.6 |
| V12141 | DS | 63J | Qtrmaster & chem equip repairer | 92.4 | 6.0 |
| X44403 | DS | 63W | Wheel vehicle repairer | 275.0 | 8.5 |
| | GS | 63W | Wheel vehicle repairer | 120.0 | 13.1 |

[a]Refer to Table 2-1 for corresponding LIN nomenclature.

Table 4-2. Base Case Results - Unconstrained

| Theater | Change in strength due to DFD | SRCs | SRC descriptions |
|---|---|---|---|
| NATO | -554 | 43237J50010<br>43237J50510<br>43237J50810<br>43238J50010<br>43238J50210<br>43509LA0010<br><br>43509LG0010 | CS CO LEMCO<br>CS TM COMSEC<br>CS TM TURB ENG REPAIR<br>CS CO HVY EQP<br>CS TM FLD ARTY REPAIR<br>CS TM TURB ENG PWR GEN REPAIR<br>MT TM WHEEL VEH |
| SWA | 0 | | |
| NEA | -200 | 43209L00010 | MT CO ORD (MAINT) |

**4-4. RESULTS OF CONSTRAINED BASE CASE RUNS.** Table 4-3 presents the results of the FASTALS runs created in the constrained mode. These runs used the original base case inputs. As can be seen in the table, any savings accomplished in the unconstrained mode were eliminated in the constrained mode. There were no savings in force structure in this case. This implies that affordability considerations in the force structure process have already cut past the point of any potential savings.

Table 4-3. Base Case Results - Constrained

| Theater | Change in Strength due to DFD | SRCs | SRC Descriptions |
|---|---|---|---|
| NATO | 0 | | |
| SWA | 0 | | |
| NEA | 0 | | |

**4-5. EXCURSIONS**

**a. Labor Savings.** As previously mentioned, two sets of excursion runs were produced as part of the sensitivity analysis. These excursions were done by varying the economic criteria used in the economic methodology. All other factors were held constant. In Excursion 1, a PLRC cutoff of $250,000 was used as the economic criteria, and in Excursion 2, $1 million was used. The variation in economic criteria created differences in labor savings and therefore produced different results in terms of force structure savings. Table 4-4 shows the labor savings in terms of the number of annual maintenance manhours subtracted from each LIN/ECH/MOS combination for the base case ($500,000) and the two excursions.

Table 4-4. Labor Savings - Base Case vs Excursions
(page 1 of 2 pages)

| LIN[a] | ECH | MOS | MOS name | Exc 1 ($250K) | Base case ($500K) | Exc 2 ($1M) |
|---|---|---|---|---|---|---|
| C10908 | DS | 63H | Track vehicle repairer | 102.2 | 108.2 | 108.2 |
| C12155 | DS | 63H | Track vehicle repairer | 3.2 | 9.9 | 14.1 |
| C76335 | DS | 41C | Fire control instrument repairer | 0.0 | 0.0 | 1.3 |
| | | 45K | Tank turret repairer | 76.9 | 83.0 | 85.8 |
| | | 63G | Fuel & elec sys repairer | 0.0 | 5.0 | 5.5 |
| D11049 | DS | 63H | Track vehicle repairer | 0.7 | 2.7 | 6.3 |
| | GS | 63H | Track vehicle repairer | 0.0 | 0.0 | 2.0 |
| D11538 | DS | 63H | Track vehicle repairer | 0.0 | 0.6 | 5.5 |
| E56896 | DS | 63H | Track vehicle repairer | 2.1 | 2.6 | 6.6 |
| J35813 | DS | 52D | Power gen equip repairer | 2.0 | 2.0 | 3.3 |
| | GS | 52D | Power gen equip repairer | 0.0 | 1.3 | 2.1 |
| J35825 | DS | 52D | Power gen equip repairer | 6.0 | 7.4 | 7.4 |
| | GS | 52D | Power gen equip repairer | 2.0 | 2.0 | 2.0 |
| J42100 | DS | 52D | Power gen equip repairer | 5.2 | 5.2 | 5.2 |
| | GS | 52D | Power gen equip repairer | 19.8 | 19.8 | 19.8 |
| J43018 | DS | 52D | Power gen equip repairer | 1.1 | 1.1 | 2.1 |
| J44055 | DS | 52D | Power gen equip repairer | 2.1 | 3.0 | 3.0 |
| J45699 | DS | 52D | Power gen equip repairer | 5.9 | 7.1 | 7.1 |
| J46110 | DS | 52D | Power gen equip repairer | 5.9 | 7.1 | 7.1 |
| J47617 | DS | 52D | Power gen equip repairer | 4.6 | 4.6 | 4.6 |
| | GS | 52D | Power gen equip repairer | 4.8 | 4.8 | 4.8 |
| J81750 | DS | 45K | Tank turret repairer | 73.0 | 80.3 | 85.8 |
| K29694 | DS | 68F | Aircraft electrician | 8.5 | 8.5 | 8.5 |
| | | 68G | Aircraft structural repairer | 17.8 | 17.8 | 17.8 |
| | | 68H | Aircraft pneudraulics repairer | 12.9 | 12.9 | 12.9 |
| | | 68J | Aircraft fire control repairer | 11.8 | 11.8 | 11.8 |
| K31042 | DS | 35M | Avionic navigational & flight control repairer | 4.0 | 6.3 | 6.3 |
| K32293 | DS | 35R | Avionic special equip repairer | 0.0 | 8.1 | 8.1 |
| K56981 | DS | 45L | Artillery repairer | 12.3 | 13.4 | 21.8 |
| K57667 | DS | 45L | Artillery repairer | 110.2 | 143.4 | 196.8 |
| | GS | 45L | Artillery repairer | 75.5 | 95.5 | 141.5 |

## Table 4-4. Labor Savings - Base Case vs Excursions (page 2 of 2 pages)

| LIN[a] | ECH | MOS | MOS name | Exc 1 ($250K) | Base case ($500K) | Exc 2 ($1M) |
|---|---|---|---|---|---|---|
| P45003 | DS | 52F | Turbine eng drvn generator repairer | 53.4 | 53.4 | 53.4 |
| | GS | 52F | Turbine eng drvn generator repairer | 16.0 | 22.5 | 22.5 |
| R50544 | DS | 44B | Metal worker | 3.5 | 3.5 | 3.5 |
| T05028 | DS | 63W | Wheel vehicle repairer | 0.0 | 3.3 | 3.3 |
| | GS | 63W | Wheel vehicle repairer | 0.0 | 0.0 | 3.3 |
| T07543 | DS | 63W | Wheel vehicle repairer | 14.2 | 14.7 | 14.7 |
| | GS | 63W | Wheel vehicle repairer | 16.6 | 21.6 | 25.6 |
| T13168 | DS | 41C | Fire control instrument repairer | 0.7 | 0.7 | 0.7 |
| | | 45G | Fire control systems repairer | 5.2 | 5.2 | 7.0 |
| | | 45K | Tank turret repairer | 32.2 | 33.6 | 43.1 |
| | GS | 45K | Tank turret repairer | 2.8 | 2.8 | 2.8 |
| T13169 | DS | 45K | Tank turret repairer | 14.7 | 15.6 | 17.4 |
| | GS | 45K | Tank turret repairer | 3.7 | 3.7 | 11.3 |
| T13374 | DS | 45G | Fire control systems repairer | 4.9 | 5.1 | 6.0 |
| | | 45K | Tank turret repairer | 51.4 | 55.2 | 65.8 |
| | GS | 45K | Tank turret repairer | 3.8 | 3.8 | 7.0 |
| T49255 | DS | 63W | Wheel vehicle repairer | 9.3 | 10.3 | 10.3 |
| | GS | 63W | Wheel vehicle repairer | 12.0 | 12.0 | 12.0 |
| T59346 | DS | 63W | Wheel vehicle repairer | 0.3 | 0.3 | 1.4 |
| | GS | 63W | Wheel vehicle repairer | 0.0 | 0.4 | 3.2 |
| T59482 | DS | 63W | Wheel vehicle repairer | 0.0 | 0.3 | 0.3 |
| | GS | 63W | Wheel vehicle repairer | 0.0 | 0.0 | 3.2 |
| T61494 | DS | 63W | Wheel vehicle repairer | 2.5 | 2.5 | 2.5 |
| | GS | 63W | Wheel vehicle repairer | 0.0 | 1.6 | 1.6 |
| T92242 | DS | 63W | Wheel vehicle repairer | 3.5 | 9.2 | 12.7 |
| | GS | 63W | Wheel vehicle repairer | 1.6 | 11.6 | 21.6 |
| V12141 | DS | 63J | Qtrmaster & chem equip repairer | 0.0 | 6.0 | 8.5 |
| X40146 | GS | 63W | Wheel vehicle repairer | 0.0 | 0.0 | 10.4 |
| X44403 | DS | 63W | Wheel vehicle repairer | 4.5 | 8.5 | 9.5 |
| | GS | 63W | Wheel vehicle repairer | 13.1 | 13.1 | 13.1 |

[a]Refer to Table 2-1 for corresponding LIN nomenclature.

**b. Results.** The results of Excursions 1 and 2, based on the labor savings shown in Table 4-4, are presented in Tables 4-5 through 4-8. Tables 4-5 and 4-6 contain the unconstrained and constrained results for Excursion 1, respectively. Tables 4-7 and 4-8 present the same for Excursion 2.

**Table 4-5. Results of Excursion 1 - Unconstrained**

| Theater | Change in strength due to DFD | SRCs | SRC descriptions |
|---|---|---|---|
| NATO | -519 | 43237J50010<br>43238J50010<br>43238J50210<br>43209LG0010 | CS CO LEMCO<br>CS CO HVY EQP MAINT<br>CS TM FIELD ARTY REPAIR<br>MT TM WHEEL VEH |
| SWA | 0 | | |
| NEA | 0 | | |

(1) In Table 4-5, it is evident that changing the economic criteria from $500,000 to $250,000 did not have a great impact on the force structure savings. The total change in strength of 519 in NATO was only 35 people fewer than in the base case. There was no change in SWA, as expected. In NEA, the one unit of 200 strength that was saved in the base case dropped out in this excursion. As Table 4-6 indicates, the constrained results were the same as they were in the base case, with zero change in all theaters.

**Table 4-6. Results of Excursion 1 - Constrained**

| Theater | Change in strength due to DFD | SRCs | SRC descriptions |
|---|---|---|---|
| NATO | 0 | | |
| SWA | 0 | | |
| NEA | 0 | | |

(2) Table 4-7 shows that doubling the cost criteria to $1,000,000 had only a small impact on results as well. In NATO, only nine additional people were added to the force structure savings over the base case. SWA results were the same as in the base case, as were the NEA results. Again, the constrained results remained at zero in all theaters, as shown in Table 4-8.

Table 4-7. Results of Excursion 2 - Unconstrained

| Theater | Change in strength due to DFD | SRCs | SRC descriptions |
|---|---|---|---|
| NATO | -563 | 43237J50010<br>43238J50010<br>43238J50210<br>43509LC0010<br>43509LC00HI<br>43509LG0010<br>43509LG00HI | CS CO LEMCO<br>CS CO HVY EQP MAINT<br>CS TM FLD ARTY REPAIR<br>MT TM TRACK VEH REPAIR<br>MT TM TRACK VEH REPAIR<br>MT TM WHEEL VEH<br>MT TM WHEEL VEH |
| SWA | 0 | | |
| NEA | -200 | 43209L00010 | MT CO |

Table 4-8. Results of Excursion 2 - Constrained

| Theater | Change in strength due to DFD | SRCs | SRC descriptions |
|---|---|---|---|
| NATO | 0 | | |
| SWA | 0 | | |
| NEA | 0 | | |

**(3)** As can be seen from Tables 4-6 through 4-3, the decrements in maintenance manhours and the resultant force structure savings did not vary to a large degree between the DFD base case and the two excursions. In other words, the sensitivity analysis showed that variations in the economic criteria did not produce large differences in the results. Figure 4-1 shows, by theater, the difference in force structure savings for the base case and the two excursions. It demonstrates that the model results were not sensitive to changes in the cost criteria.

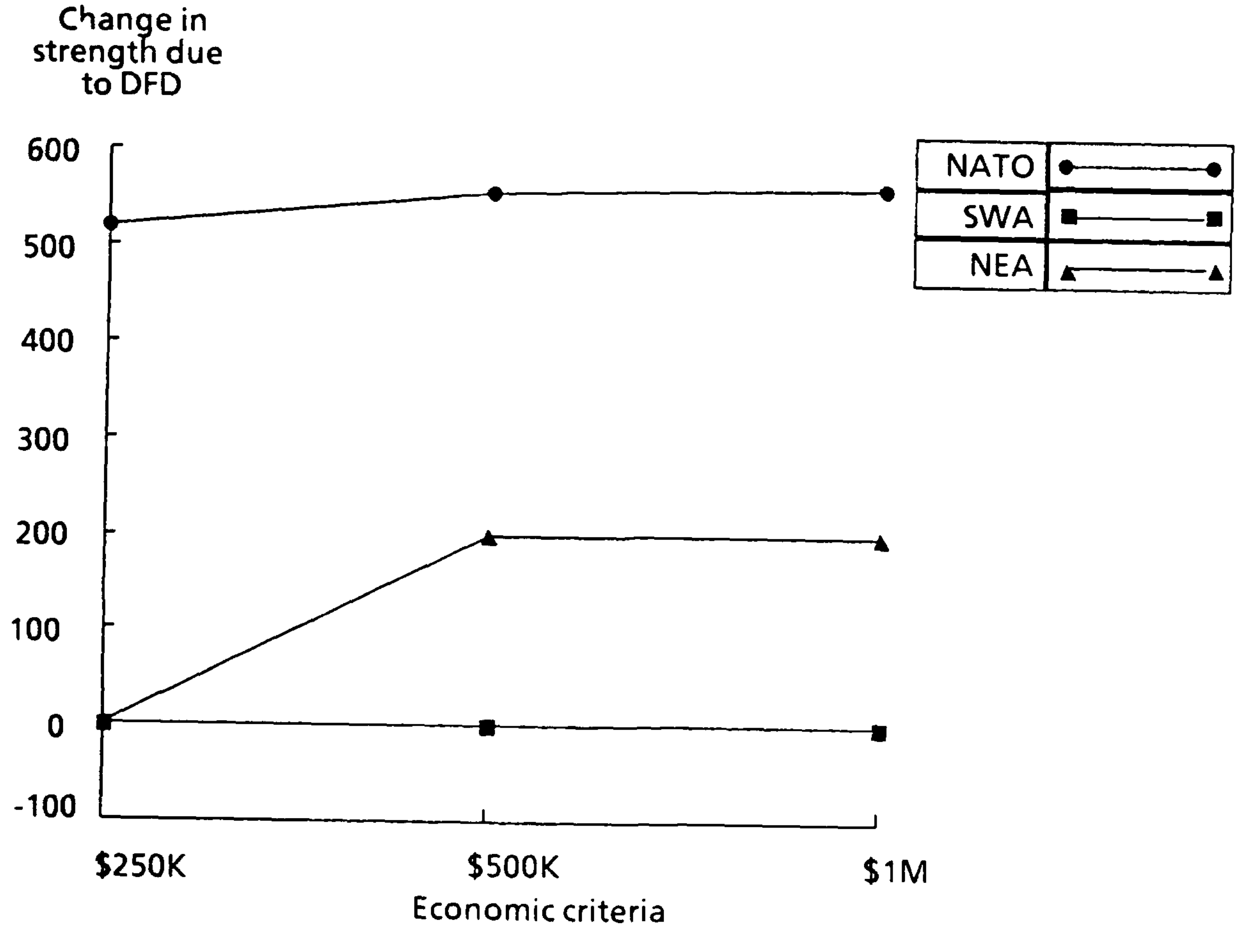



Figure 4-1. Results by Theater (unconstrained), Base Case and Excursions

**4-6. MAGNITUDE OF FORCE STRUCTURE SAVINGS.** Table 4-9 provides insight into the magnitude of the force structure savings achieved in this study. The largest drop in strength for each theater, which occurred in Excursion 2, is shown along with the beginning strength or total population in the theater at the outset of the FASTALS run. The percentage change between the beginning strength and the savings in strength due to DFD shows that the savings are not significant. Table 4-10 presents the same information, but, in place of the beginning strength, the beginning maintenance strength (a subset of the total population) is provided by theater. The drop in strength relative to the beginning maintenance population is also very small.

Table 4-9. Magnitude of Force Structure Savings
(relative to beginning strength)

| Theater | Beginning total strength | Largest drop in strength | Percentage change |
|---|---|---|---|
| NATO | 1,106,000 | 563 | -.05% |
| SWA | 408,000 | 0 | 0% |
| NEA | 139,000 | 200 | -.14% |

Table 4-10. Magnitude of Force Structure Savings
(relative to beginning maintenance strength)

| Theater | Beginning maintenance strength | Largest drop in strength | Percentage change |
|---|---|---|---|
| NATO | 40,867 | 563 | -1.4% |
| SWA | 18,485 | 0 | 0% |
| NEA | 6,557 | 200 | -3.0% |

## 4-7. ANSWERS TO EEA

**a. EEA 1.** The first EEA was to identify existing reparable components for possible reclassification as throwaway components. Table B-1 in Appendix B shows, by LIN and NSN, components currently classified as reparable which were identified in the DFD Study as throwaway candidates. (Note that NSN nomenclature fields were provided with a maximum width of 19 characters. Many of the names are cut off at that point.)

**b. EEA 2.** The second EEA was to identify military spaces by MOS and SRC which could be realigned or converted to other MOSs. The military spaces identified in the DFD Study as candidates for possible conversion are those listed in Table 4-1 by LIN, ECH, and MOS. The SRCs associated with these MOSs are those shown in Table 4-2 (for the base case).

**c. EEA 3.** EEA 3 was to determine the impact on the Army force structure of the DFD concept within the limits of the DFD Study. In terms of results produced in this study, force structure savings appear to be negligible. However, this determination was made on the basis of available tools and data. Discussion about what conclusions can be drawn from the results of this study and recommendations for further study are presented in the next paragraph.

**4-8. CONCLUSIONS AND RECOMMENDATIONS.** The purpose of the DFD Study was to determine the impact of DFD on the Army's CSS force structure. At face value, the results of the study indicate that force structure savings resulting from the use of the DFD concept are nonexistent to negligible. These results, however, were heavily dependent on the methodology used and the available tools. The study results are inconclusive in that they do not provide a strong basis for a decision as to the usefulness of the DFD concept. It is not felt that a decision regarding the implementation of the DFD concept should be made based *solely* on the study results. The reasons for this assessment are the following.

**a.** One of the fundamental concepts on which the DFD Study was based was the economic methodology. The PLRC was used as the basis for the decision as to whether a component would be considered for reclassification from a reparable component to a discardable item. Labor savings (the number of maintenance manhours that would be saved by reclassifying these components) were then computed for the items meeting the economic criteria. It is recommended that further study be done which would focus on the components which require the greatest number of manhours to repair, rather than using cost criteria as the primary consideration.

**b.** The only tool available at CAA to measure a change in CSS force structure is the FASTALS Model. FASTALS provided a means to assess savings in terms of entire units, based on reductions in maintenance manhours applied through the use of the MARC file. The changes made to the MARC file for the DFD Study were considered small in relation to changes made in other applications. Reductions in manhours amounted to about 8 percent (for the 46 end items making up 48 percent of the total maintenance workload). FASTALS is not sensitive to small changes in MARC data. That is, it is not unusual for a strength change of zero (i.e., no units "kick out") to result from small changes in MARC data. Also, FASTALS does not provide insights into force structure savings at any level less than unit level. This means that savings by SRC are available, but savings by MOS within SRC are not. Other inherent properties of the FASTALS Model that affect results are such things as rounding rules, allocation rules, and number of time periods considered. These properties had some effect on the results of the DFD Study as well.

**c.** It is recommended that further study of the DFD concept be conducted by TRADOC, possibly to include component replacement, in lieu of repair, resulting from combat damage. As long as the Army's maintenance structure remains as it is, it is felt that any assessment of force structure savings will have results similar to those of this study. The maintenance structure must be redesigned to allow for the DFD concept before any significant savings in force structure can be realized. Changes in unit design and allocation rules are necessary for the DFD concept to prove productive in the area of force structure savings.

# APPENDIX A

# STUDY CONTRIBUTORS

## 1. STUDY TEAM

### a. Study Director

Ms. Julianne Allison, Office of the Special Assistant for Model Validation

### b. Team Member

Mr. Giles D. Mills III

### c. Other Contributors

Mr. Kenneth E. Allison

## 2. PRODUCT REVIEW BOARD

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Ms. Rebecca Merle

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Dr. Donald Orr, Inventory Research Office, US Army Materiel Systems Analysis Activity

# APPENDIX B

## CANDIDATES FOR RECLASSIFICATION AS DISCARDABLE ITEMS

| LIN/NSN* | NSN nomenclature |
|---|---|
| C10908 | |
| 2510010934311 | WIRING HARNESS, BRAN |
| 2520008949535 | TRANSFER ASSEMBLY A |
| 2520009649203 | FINAL DRIVE WITH CO |
| 2530001320842 | ARM ASSEMBLY, PIVOT |
| 2530005370372 | ARM ASSEMBLY, PIVOT |
| 2530005370434 | ARM ASSEMBLY, SUSPEN |
| 2530011885089 | BRAKE, HYDRAULIC |
| 2540007821169 | FAN, PERSONNEL HEATE |
| 2540011623834 | HEATER, VEHICULAR, CO |
| 2540011695159 | HEATER, VEHICULAR, CO |
| 2540011799024 | SHROUD, DOOR |
| 2590004463639 | WIRING HARNESS, BRAN |
| 2590008712834 | PUMP, BILGE |
| 2590011583087 | ACTUATOR, HYDRAULIC |
| 2815010403120 | ENGINE W CONTAINER |
| 2815011757342 | ENGINE, DIESEL |
| 2910000893947 | TANK, FUEL, ENGINE |
| 2910007821376 | PUMP, FUEL AND HANGE |
| 2910009377435 | PUMP, FUEL, ELECTRICA |
| 2910009379539 | TANK, FUEL, ENGINE |
| 2920004751446 | GENERATOR, ENGINE AC |
| 2930009216475 | DRIVE ASSEMBLY, FAN |
| 2930010383666 | RADIATOR, ENGINE COO |
| 4140000162615 | FAN, CENTRIFUGAL |
| 4140007563612 | FAN, VANEAXIAL |
| 4320008712834 | PUMP, BILGE |
| 6105010921484 | MOTOR, DIRECT CURRENT |
| 6105012005091 | MOTOR, DIRECT CURRENT |
| 6130009999825 | RECTIFIER ASSEMBLY |
| 6140012101964 | BATTERY, STORAGE |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| C12155 | |
| 2540010870998 | SUPPORT RING, COMMAN |
| 3040010529047 | BELL CRANK |
| 6135010764282 | BATTERY BOX |
| C76335 | |
| 1005010990163 | TRAVEL LOCK ASSY |
| 1005010991746 | CABLE ASSEMBLY, 2W17 |
| 1005010991747 | CABLE ASSEMBLY |
| 1005010991748 | CABLE ASSEMBLY |
| 1005011091557 | CAMSHAFT ASSEMBLY |
| 1005011103420 | BOX, FEEDER, AMMO |
| 1005011114048 | CIRCUIT CARD ASSY |
| 1005011126331 | CABLE ASSY |
| 1005011128254 | LEVER, REMOTE CONTRO |
| 1005011128556 | CAMSHAFT ASSEMBLY, T |
| 1005011128571 | CABLE ASSY SW, ELEC |
| 1005011140072 | CAMSHAFT ASSEMBLY E |
| 1005011179821 | CONTROL BOX, WEAPON |
| 1005011408144 | WIRING HARNESS, BRAN |
| 1005011988684 | GRIP ASSEMBLY, CONTR |
| 1005011988685 | GRIP ASSEMBLY, CONTR |
| 1005012042418 | GRIP ASSEMBLY, CONTR |
| 1430010860932 | CONTROL BOX, TOW |
| 2540011077554 | SEAT, GUNNERS |
| 2540011114963 | SEAT, COMMANDERS |
| 2590011024655 | WIRING HARNESS, BRAN |
| 5340011400211 | CLEVIS, ROD END |
| 5905011295991 | RESISTOR, STEP BY ST |
| 5930011122489 | SWITCH, SENSITIVE |
| 5930011128500 | SWITCH, SENSITIVE |
| 6230012372953 | LIGHT, EXTENSION |
| 6350011122795 | ANNUNCIATOR |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| D11049 | |
| 2590007409565 | BRANKE BAND AND LINI |
| 2920010319027 | STARTER, ENGINE, ELEC |
| 2940001035797 | BODY, AIR CLEANER |
| D11533 | |
| 2990000741948 | HEATER ASSEMBLY, AIR |
| E56896 | |
| 1005006108986 | LOCK ASSEMBLY, PINTL |
| 2520010764262 | UNIVERSAL JOINT |
| 2530010373310 | ARM, TRACK IDLER |
| 2590004462487 | CYLINDER ASSEMBLY, A |
| J35813 | |
| 2910010472012 | PUMP, FUEL, INJECTION |
| J35825 | |
| 2805012500039 | GOVERNOR ASSEMBLY |
| 2920012017370 | MODULATOR ASSEMBLY, |
| 2990010852554 | DUCT AND SHUTTER AS |
| J42100 | |
| 2805004547511 | CRANKCASE ASSEMBLY |
| 5950007878615 | TRANSFORMER, CURRENT |
| 6110007647621 | REGULATOR, VOLTAGE |
| 6115002512087 | CONTROL BOX ASEMBL |
| 6115009407859 | ROTOR ASSEMBLY, GENE |
| J43918 | |
| 6150009097339 | WIRING HARNESS, BOXR |
| J44055 | |
| 2805012500039 | GOVERNOR ASSEMBLY |
| 2920012017370 | MODULATOR ASSEMBLY, |
| 6115007645464 | FRAME |
| 6150009097339 | WIRING HARNESS, BOXR |
| J45699 | |
| 6110007647621 | REGULATOR, VOLTAGE |
| 6115009490604 | HOUSING ASSEMBLY, GE |
| 6115009995675 | GENERATOR ASSEMBLY |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| J46110 | |
| 6110007647621 | REGULATOR, VOLTAGE |
| 6115009490604 | HOUSING ASSEMBLY, GE |
| 6115009995675 | GENERATOR ASSEMBLY |
| J47617 | |
| 2805000178330 | CYLINDER, ENGINE, GAS |
| 6110007647621 | REGULATOR, VOLTAGE |
| 6110009139275 | DISTRIBUTION BOX |
| 6115011715858 | HOUSING ASSEMBLY |
| J81750 | |
| 1005010990163 | TRAVEL LOCK ASSY |
| 1005010991746 | CABLE ASSEMBLY, 2W17 |
| 1005010991747 | CABLE ASSEMBLY |
| 1005010991748 | CABLE ASSEMBLY |
| 1005011091557 | CAMSHAFT ASSEMBLY |
| 1005011103420 | BOX, FEEDER, AMMO |
| 1005011114048 | CIRCUIT CARD ASSY |
| 1005011126331 | CABLE ASSY |
| 1005011128254 | LEVER, REMOTE CONTRO |
| 1005011128556 | CAMSHAFT ASSEMBLY, T |
| 1005011128571 | CABLE ASSY SW, ELEC |
| 1005011140072 | CAMSHAFT ASSEMBLY, E |
| 1005011179821 | CONTROL BOX, WEAPON |
| 1005011408144 | WIRING HARNESS, BRAN |
| 1005011988684 | GRIP ASSEMBLY, CONTR |
| 1005011988685 | GRIP ASSEMBLY, CONTR |
| 1005012042418 | GRIP ASSEMBLY, CONTR |
| 2540011077554 | SEAT, GUNNERS |
| 5340011400211 | CLEVIS, ROD END |
| 5905011295991 | RESISTOR, STEP BY ST |
| 5930011122489 | SWITCH, SENSITIVE |
| 5930011128500 | SWITCH, SENSITIVE |
| 6230012372953 | LIGHT, EXTENSION |
| 6350011122795 | ANNUNCIATOR |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| K29694 | |
| 1560001336224 | FITTING ASSEMBLY, MO |
| 1560008160790 | DOOR, ACCESS |
| 1560009731754 | TANK, LUBRICATING OI |
| 1615000701130 | DAMPER ASSEMBLY, TRA |
| 1630002470249 | KID TUBE ASSY, LH |
| 1650010596006 | HYDRAULIC UNIT, MODU |
| 1680001323364 | PANEL, INDICATING, LI |
| 2915000035904 | FILTER, FLUID |
| 2915011245222 | PUMP, SUBMERGED, AIRC |
| K31042 | |
| 1560011101443 | DOOR ASSEMBLY, CREW, |
| 6220001795106 | LIGHT, NAVIGATIONAL, |
| K32293 | |
| 1560011101443 | SLIDE ASSEMBLY, WIND |
| K56981 | |
| 1025005570575 | PIN, HINGE |
| 1025010325114 | TORQUE LOCK, DRIVE A |
| 1025010325116 | DIFFERENTIAL GEAR U |
| 1025010414385 | HEADLINK ASSEMBLY |
| 1025012279770 | CYLINDER ASSEMBLY, A |
| 1030007910143 | COUNTERBALANCE ASSE |
| 2520010377279 | FINAL DRIVE, TRAVERS |
| 3010005362773 | GEAR ASSEMBLY, SPEED |
| 3040009811251 | HEAD, LINEAR ACTUATI |
| 3040012275546 | CAM, CONTROL |
| 5340010197144 | LATCH SET, RIM |
| 5340010311757 | LOCK SET, RIM |
| K576670 | |
| 1015006093977 | VALVE, SAFETY RELIEF |
| 1025000195267 | CRANK, OPERATING ASS |
| 1025001150627 | CYLINDER ASSEMBLY, L |
| 1025001272921 | ACCUMULATOR, HYDRAUL |
| 1025001778345 | VALVE ASSEMBLY |
| 1025001797142 | COVER ASSEMBLY, POWE |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| K576670 (cont) | |
| 1025001837678 | MANIFOLD ASSEMBLY |
| 1025003320083 | VALVE, SHUTTEL ASSY |
| 1025004396541 | LEVER, CAM ASSEMBLY |
| 1025006893405 | EYE ASSEMBLY, CYLIND |
| 1025006893406 | EYE ASSEMBLY, PISTON |
| 1025008022465 | HOUSING ASSEMBLY |
| 1025008166592 | BEARING UNIT, HAND D |
| 1025008688060 | GEARSHAFT ASSEMBLY, |
| 1025009197277 | RECUPERATOR CYLINDE |
| 1025009197905 | COVER, RECUPERATOR C |
| 1025009298328 | SHIM |
| 1025009997931 | HOUSING, FIRING MECH |
| 1025010189182 | SUPPORT ASSY, REAR |
| 1025010552790 | BODY ASSEMBLY |
| 1025010561250 | CYLINDER, BUFFER |
| 1025010592488 | VALVE ASSEMBLY RAMM |
| 1025010643374 | ROLLER ASSEMBLY |
| 1025010703223 | HANDLE ASSEMBLY |
| 1025010710623 | RETAINER ASSEMBLY |
| 1025010927901 | POWER PACK ASSEMBLY |
| 1025010950899 | MOUNT ASSEMBLY |
| 1025012532033 | FILTER, FLUID ASSEMB |
| 1240003285623 | M145 MT TEL |
| 1240004888665 | LEVEL ASSEMBLY |
| 1240008640343 | CELL ASSEMBLY, OPTIC |
| 1240008640363 | TEL P M 117A2 |
| 1240008715475 | M15 QUAD FC |
| 1240011495951 | QUADRANT SUPPORT AS |
| 1240011495952 | COUNTER BOX ASSEMBL |
| 1240011789752 | LAMP ASSEMBLY, TELES |
| 1290004707504 | QUAD M1A1 |
| 1290008919999 | QUADRANT, FIRE CONTR |
| 1290008962236 | QUADRANT, FIRE CONTRO |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| K576670 (cont) | |
| 1290011484821 | LIGHT, AIMING POST |
| 2520004751278 | BODY, VALVE, BYPASS |
| 2520005080126 | ACCUMULATOR |
| 2520008883715 | HANDLE, GUNNERS CON |
| 2520009722625 | VALVE, RELIEF, TURRET |
| 2520009722627 | MOTOR, HYDRAULIC |
| 2590001797159 | HARNESS, HANDLE GUNN |
| 2590002694853 | WIRING HARNESS, BRANC |
| 2590008235586 | LEAD ASSEMBLY, ELECT |
| 3040009318206 | CONNECTING LINK, RIG |
| 4320001743439 | PUMP, AXIAL PISTONS |
| 4320009307862 | PUMP ASSEMBLY |
| 4810004706533 | VALVE, LINEAR, DIRECT |
| 4820004751272 | BODY, SELECTOR VALVE |
| 5315000852261 | PIN, SHOULDER, HEADLE |
| 5340001747758 | PLUNGER ASSEMBLY, CA |
| 5340010691591 | DOOR, ACCESS |
| 5355008986791 | KNOB ASSEMBLY |
| 5925008405393 | CIRCUIT BREAKER |
| 5935007388305 | CONNECTOR, RECEPTICL |
| 5935007751500 | RECEPTICLE WIRING H |
| 5975000531074 | INTERCONNECTING BOX |
| 6105010953087 | MOTOR, DIRECT CURREN |
| 6150000840240 | LEAD ELECTRICAL, BRA |
| 6150009673351 | LEAD ELECTRICAL, BRA |
| 6150010718507 | WIRING HARNESS |
| 9340004939060 | WINDOW, OBSERVATION |
| K576671 | |
| 1015006093977 | VALVE, SAFETY RELIEF |
| 1025001150627 | CYLINDER ASSEMBLY,L |
| 1025001837678 | MANIFOLD ASSEMBLY |
| 1025003320083 | VALVE, SHUTTLE ASSY |
| 1025004396541 | LEVER, CAM ASSEMBLY |
| 1025006893405 | EYE ASSEMBLY, CYLIND |
| 1025006893406 | EYE ASSEMBLY, PISTON |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| K576671 (cont) | |
| 1025008022465 | HOUSING ASSEMBLY |
| 1025008166592 | BEARING UNIT, HAND D |
| 1025008688060 | GEARSHAFT ASSEMBLY, |
| 1025009197905 | COVER, RECUPERATOR C |
| 1025010552790 | BODY ASSEMBLY |
| 1025010592488 | VALVE ASSEMBLY RAMM |
| 1025010643374 | ROLLER ASSEMBLY, CUR |
| 1025010710623 | RETAINER ASSEMBLY |
| 1025010927901 | POWER PACK ASSEMBLY |
| 1025010950899 | MOUNT ASSEMBLY |
| 1025012532033 | FILTER, FLUID ASSEMB |
| 1240001150637 | WIRING HARNESS, BRAN |
| 1240004888665 | LEVEL ASSEMBLY |
| 1240008640343 | CELL ASSEMBLY, OPTIC |
| 1240008640363 | TEL P M117A2 |
| 1240008642933 | PERISCOPE |
| 1240008688381 | PRISM, DOVE, ASSEMBLY |
| 1240008706277 | GEAR-PRISM OPTICAL |
| 1240011495951 | QUADRANT SUPPORT AS |
| 1240011495952 | COUNTER BOX ASSEMBL |
| 1240011506094 | CELL ASSEMBLY, OPTIC |
| 1240011518841 | RETICLE ASSEMBLY, OP |
| 1240011656247 | SEGMENT ASSEMBLY, GE |
| 1240011789752 | LAMP ASSEMBLY, TELES |
| 1290008919999 | QUADRANT, FIRE CONTR |
| 1290008962236 | QUADRANT, FIRE CONTR |
| 2520004751278 | BODY, VALVE, BYPASS |
| 2520005080126 | ACCUMULATOR |
| 2520008883715 | HANDLE, GUNNERS CON |
| 2520009722625 | VALVE, RELIEF, TURRET |
| 2590001797159 | HARNESS, HANDLE GUNN |
| 3040009318206 | CONNECTING LINK, RIG |
| 4810004706533 | VALVE, LINEAR, DIRECT |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| K576671 (cont) | |
| 4820004751272 | BODY, SELECTOR VALVE |
| 5315000852261 | PIN, SHOULDER, HEADLE |
| 5355008986791 | KNOB ASSEMBLY |
| 9340004939060 | WINDOW, OBSERVATION |
| P45003 | |
| 2835004204332 | DRIVE ASSY, DUAL PAD |
| 2835008638496 | GEAR BOX, ACCESSORY D |
| 2910009081429 | FUEL CONTROL, ASSY |
| 2920009330578 | WIRE HARNESS |
| 2930003374818 | COOLER/REG ASSY, OIL |
| 4130008638549 | WIRE HARNESS |
| 4130009330570 | FAN, RECIRCULATE ASSY |
| 6115002479944 | WIRE HARNESS |
| 6115002479947 | WIRE HARNESS |
| 6115002489988 | WIRE HARNESS |
| 6115004557712 | WIRE HARNESS |
| 6115008337785 | WIRE HARNESS |
| 6115008437627 | WIRE HARNESS |
| 6115008437650 | WIRE HARNESS, HEAT |
| 6115008438605 | WIRE HARNESS |
| 6115008438621 | WIRE HARNESS |
| 6115008592382 | WIRE HARNESS |
| 6115008716658 | WIRE HARNESS |
| 6150002480063 | WIRE HARNESS |
| R50544 | |
| 2510004381595 | DOOR, HATCH, VEHICLE |
| 2510004434864 | DOOR, HATCH, VEHICLE |
| 2510004434865 | DOOR, HATCH, VEHICLE |
| 2510004434879 | DOOR, METAL SWINGING |
| 2510004535448 | TREAD, METALLIC, NONS |
| 2510004535449 | TREAD, METALLIC, NONS |
| 2510004535450 | TREAD, METALLIC, NONS |
| 2510004535451 | TREAD, METALLIC, NONS |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| T05028 | |
| 2530011479329 | CALIPER, DISC BRAKE |
| 2530011529305 | DRUM ASM-RR BRK |
| 2530011566190 | CALIPER, DISC BRAKE |
| T07543 | |
| 2510011739316 | TAILGATE, VEHICLE BO |
| 2510011739347 | HOOD, ENGINE COMPART |
| 2520011491866 | BODY ASSEMBLY, PUMP, |
| 2520011885115 | AXLE ASSEMBLY, AUTOM |
| 2530011687876 | PUMP ASSEMBLY, POWER |
| 2530011856712 | ROTOR |
| 2530012042583 | HOUSING ASSEMBLY, CA |
| 2530012076256 | HOUSING ASSEMBLY, CA |
| 2540011975524 | TOP ASSEMBLY, TRUCK |
| 2540011975528 | CURTAIN, VEHICULAR |
| 2815011658216 | CYLINDER HEAD, DIESE |
| 2910011714636 | PUMP, FUEL, METERING |
| 2930011687870 | DRIVE, FAN |
| 2930011687911 | COOLER, LUBRICATING |
| 2930011992398 | RADIATOR, ENGINE COO |
| T13168 | |
| 1015011815924 | LOCK, BEARING |
| 1015011815925 | LOCK, BEARING |
| 1015012032735 | ROTOR, GUN MOUNT |
| 1220010781138 | BRACKET-RECEPTABLE |
| 1230011586805 | SHIPPING AND STORAG |
| 1230011602953 | SHIPPING AND STORAG |
| 1240010761815 | HOUSING |
| 1240010787615 | STOP |
| 1240010787617 | ARM, PIVOT |
| 1240010787727 | CONNECTING LINK, FOV |
| 1240011816018 | HOLDER, OPTICAL ELEM |
| 1240011819069 | HOUSING ASSEMBLY |
| 1240011924058 | OBJECTIVE AND RELAY |
| 1240012546344 | CELL, OPTICAL ELEMEN |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| T13168 (cont) | |
| 2510010749011 | DOOR, HATCH, VEHICLE |
| 2520005080126 | ACCUMULATOR |
| 3040012746354 | CONNECTING LINK, RIG |
| 3040012752589 | CONNECTING LINK, RIG |
| 5340010761874 | COVER, ACCESS |
| 5340010766867 | COVER, ACCESS |
| 5340010781301 | COVER, ACCESS |
| 5340012746342 | COVER, ACCESS |
| 5935004084368 | CONNECTOR, |
| 5935010781292 | CONNECTOR ASSEMBLY, |
| T13169 | |
| 1015001139602 | HANGER, TURRET PLATE |
| 1015005663827 | SHAFT, OVERRIDE ELEV |
| 1015005663840 | SHAFT, OVERRIDING, TR |
| 1015006093977 | VALVE, SAFETY RELIEF |
| 1015006466858 | YOKE ASSEMBLY PUMP |
| 1015007792532 | SHIELD ASSEMBLY |
| 1015010144716 | BOX, ASSEMBLY, AMMUNI |
| 1015010217266 | HOUSING ASSEMBLY |
| 1015010327144 | HOUSING ASSEMBLY |
| 1240004579370 | HANDLE ASSEMBLY |
| 1240011819069 | HOUSING ASSEMBLY |
| 2520004517713 | BOX ASSEMBLY |
| 5305008007261 | SET SCREW |
| 6130012692279 | POWER SUPPLY SUBASS |
| T13374 | |
| 1015010749018 | WIRING HARNESS, BRAN |
| 1015010766722 | ROTOR, GUN MOUNT |
| 1015010766783 | WIRING HARNESS |
| 1015010766784 | WIRING HARNESS |
| 1015010766785 | WIRING HARNESS |
| 1015010766786 | WIRING HARNESS |
| 1015010766787 | WIRING HARNESS |
| 1015010766790 | WIRING HARNESS |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| T13374 (cont) | |
| 1015011084930 | EXTRACTOR ASSEMBLY |
| 1015011084931 | EXTRACTOR, CARTRIDGE |
| 1015012240081 | PLATE, SPRING AND BU |
| 1220010781138 | BRACKET-RECEPTACLE |
| 1230011586802 | SHIPPING AND STORAG |
| 1230011586805 | SHIPPING AND STORAG |
| 1230011602953 | SHIPPING AND STORAG |
| 1240010787615 | STOP |
| 1240010787617 | ARM, PIVOT |
| 1240010787727 | CONNECTING LINK, FOV |
| 1240011816018 | HOLDER, OPTICAL ELEMEN |
| 1240011819069 | HOUSING ASSEMBLY |
| 2520005080126 | ACCUMULATOR |
| 3040012746354 | CONNECTING LINK, RIG |
| 3040012752589 | CONNECTING LINK, RIG |
| 5340010766867 | COVER, ACCESS |
| 5340010781301 | COVER, ACCESS |
| 5340012746342 | COVER, ACCESS |
| 5935004084368 | CONNECTOR, |
| 5935010781292 | CONNECTOR ASSEMBLY, |
| 5995011054006 | CABLE ASSEMBLY, SPEC |
| 6150012718016 | CABLE ASSEMBLY, SPEC |
| T49255 | |
| 2520011097958 | VALVE ASSEMBLY, TRAN |
| 2530012225482 | CYLINDER ASSEMBLY, |
| 2815000546945 | OIL PUMP ASSEMBLY, E |
| 2910011148608 | PUMP, FUEL, METERING |
| 2930011013047 | RADIATOR, ENGINE COO |
| 3040011013726 | CYLINDER ASSEMBLY, A |
| 3040011017460 | CYLINDER ASSEMBLY, A |
| 3040011017461 | CYLINDER, ACTUATING |
| 3040011024224 | CYLINDER, ACTUATING |
| 6110002781044 | STARTER, MOTOR |
| 6115011023063 | GENERATOR, ALTERNATI |
| 6140000572554 | BATTERY, STORAGE |

*Refer to Table 2-1 for LIN nomenclatures.

| LIN/NSN* | NSN nomenclature |
|---|---|
| T59346 | |
| 2530011478556 | PUMP ASSEMBLY, POWER |
| 2530011482914 | BRAKE DRUM |
| T59482 | |
| 2530011482914 | BRAKE DRUM |
| T61494 | |
| 2510011739316 | TAILGATE, VEHICLE BO |
| 2520011491866 | BODY ASSEMBLY, PUMP, |
| 2530011856712 | ROTOR |
| 2530012042583 | HOUSING ASSEMBLY, CA |
| 2530012076256 | HOUSING ASSEMBLY, CA |
| T92242 | |
| 2510011739316 | TAILGATE, VEHICLE BO |
| 2520011491866 | BODY ASSEMBLY, PUMP, |
| 2520011885115 | AXLE ASSEMBLY, AUTOM |
| 2530011687876 | PUMP ASSEMBLY, POWER |
| 2530011856712 | ROTOR |
| 2530012042583 | HOUSING ASSEMBLY, CA |
| 2530012076256 | HOUSING ASSEMBLY, CA |
| 2930011687870 | DRIVE, FAN |
| 2930011687911 | COOLER, LUBRICATING |
| V12141 | |
| 4930011272219 | REEL, LH |
| 4930011362089 | REEL ASSEMBLY, RIGHT |
| X44403 | |
| | |
| 2520010730056 | TRANSFER TRANSMISSI |
| 2520010904556 | POWER TAKEOFF, TRANS |
| 2520010996350 | CARRIER ASSEMBLY, DI |
| 2910010793452 | TANK, FUEL, ENGINE |
| 2910011127712 | INJECTOR ASSEMBLY, F |
| 2930010969035 | PUMP, WATER, ENGINE |
| 2930010969199 | IDLER ASSEMBLY, WATE |
| 4320010742917 | PUMP, ROTARY |

*Refer to Table 2-1 for LIN nomenclatures.

# APPENDIX C

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# APPENDIX D

# THE FASTALS MODEL

**D-1. MODEL DESCRIPTION AND APPLICATIONS.** The purpose of the FASTALS Model is to compute administrative and logistical workloads and to generate the theater level support force structure necessary to round out a combat force in a postulated confrontation. FASTALS, a requirements model, may be used in any force planning simulation to develop a force that is balanced, time-phased, and geographically distributed. A trooplist is said to be balanced when the individual units comprising the list are capable of accomplishing the various workloads generated by the total force. Trooplists are said to be time-phased when unit requirements are prescribed for each time period in the simulation. The major elements of support are maintenance, construction, supply, transportation, hospitalization and evacuation, and personnel replacement. Major Department of the Army (DA) studies utilizing FASTALS include TAA, OMNIBUS, and the Joint Strategic Planning Document Analysis (JSPDA). The model is also used in excursions to assess the impact of force modernization, logistic initiatives and host nation support contributions on US force structure requirements.

**D-2. INPUTS.** Each study has its own set of data files for each theater examined. The data must reflect the force being portrayed on the force tape, which has been prepared by the study proponent. The two major input files are described below.

**a. Masterfile (MF).** This file contains data necessary to allocate units and to prescribe unit support requirements. Key entries include:

**(1) Logical Region (LR).** Reflects a unit's normal echelon of operation in the theater (1 - division, 2 - corps, 3 - rear combat zone, 4 - COMMZ, 5 - ports, 6 - offshore). LRs are further delineated into three sectors which divide the LRs into horizontal borders. For example, in NATO, the three sectors generally represent Northern Army Group (NORTHAG) (Sector 1) and Central Army Group, Central Europe (CENTAG) (Sectors 2 and 3).

**(2) Allocation Rules (AR).** The most critical of all MF data. An AR is a statement of a unit's capability, mission and/or doctrinal employment and, in conjunction with other data, determines how many of a certain type unit will be reflected in the final trooplist of requirements. All rules are coordinated with the study sponsor and the TRADOC community. Three types of AR exist:

**(a) Manual Entry.** Units are placed directly into the scenario by time period and location. Almost all combat units are entered manually, as are a limited number of CS/CSS units that have a special mission or fixed quantity (i.e., petroleum pipeline companies that operate emergency pipelines in accordance with certain contingency plans).

**(b) Existence Rule.** Units are allocated based on the existence of some other unit(s) in the theater. This allows the theater to be rounded out in accordance with normal TOE doctrine.

(c) **Workload Rule.** Units are allocated based on the capability to accomplish generated workloads.

Other data found in the MF include standard requirements codes, unit descriptions, strengths and weights of the units.

**b. Scenario.** This data set represents the major variable inputs which, when combined with the MF, generates the statement of support force requirements.

(1) **Combat Simulation Data.** The combat data required to run FASTALS include unit location and employment time, level of combat intensity, ammunition consumption, damaged and repairable tanks/armored personnel carriers (APCs), casualties, and changes in forward edge of the battle area (FEBA).

(2) **Other Data.** Other data provided include a layout of the theater's geographical structure; number of forward deployed and prepositioned materiel configured to unit sets (POMCUS) units; prepositioned war reserve materiel stock (PWRMS), stockage policy and supply data; engineer construction policy; and transportation data representing links, paths, and capacities for each mode (highway, railroad, waterway, pipeline).

**D-3. EXECUTION.** First, the combat units employed by the combat model are augmented by direct input units and by units that are implied by the organizational structure of the theater being analyzed (e.g., number of corps). Next, units that are required on the basis of the existence of other units in the theater are added to the list. The model then computes workloads generated by these units in terms of personnel replacements, hospital admissions, supplies, maintenance, construction, and transportation. These workloads are then used as a basis for adding units such as hospitals and medium truck companies. This new set of units generates another increment, and so the cycling process begins. Additional units increase the workloads which, in turn, generate a requirement for more units. This cyclic process, steps 5 through 13 in Figure D-1, continues until the model computes the same set of units (trooplist) that was computed on the previous cycle (requirements converge).

**D-4. OUTPUTS.** The principle output produced is the time-phased troop deployment list of theater requirements. Other reports provide consumption and stockage requirements for each category of supply. Additional reports include 48 workload summaries that relate to personnel replacements, medical, materiel, maintenance, construction, transportation, and casualties.

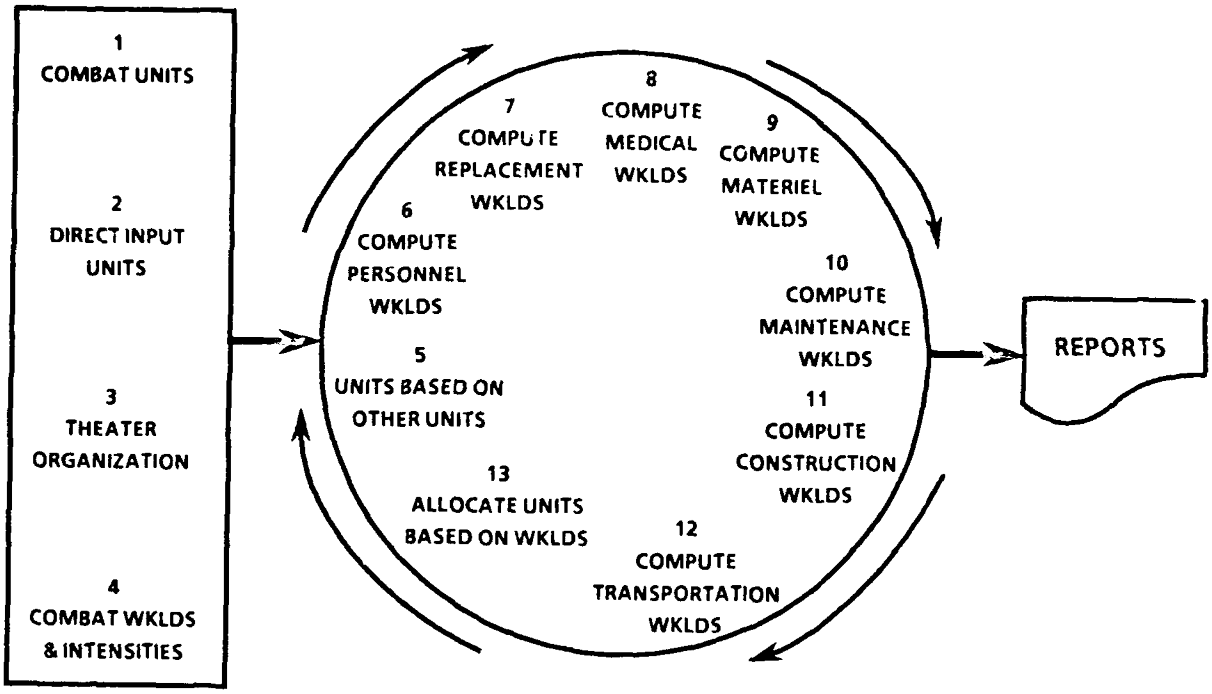


Figure D-1. FASTALS Logic Flow

# APPENDIX E

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# GLOSSARY

## ABBREVIATIONS, ACRONYMS, AND SHORT TERMS

| | |
|---|---|
| AMC | US Army Materiel Command |
| AMCCOM | US Army Armament, Munitions, and Chemical Command |
| AMM | ammunition |
| AMSAA | Army Materiel Systems Analysis Activity |
| APC | armored personnel carrier |
| AR | allocation rules |
| AVSCOM | Aviation Systems Command |
| CAA | US Army Concepts Analysis Agency |
| CECOM | Communications-Electronics Command |
| CENTAG | Central Army Group, Central Europe |
| COMMZ | communications zone |
| COMPO | component code |
| CS | combat support |
| CS CO | combat support company |
| CS HHC | combat support headquarters |
| CS TM | combat support team |
| CSS | combat service support |
| DA | Department of the Army |
| DENS | density |
| DEP | depot |
| DFD | Design for Discard (study) |
| DG | Defense Guidance |
| DS | direct support |
| ECH | echelon |
| EEA | essential element(s) of analysis |

| | |
|---|---|
| EQUIP | equipment |
| F | flying hours |
| FASTALS | Force Analysis Simulation of Theater Administrative and Logistic Support (model) |
| FEBA | forward edge of the battle area |
| FF1 | Failure Factor 1 |
| FF2 | Failure Factor 2 |
| FGC | functional group code |
| FOP | first opportunity |
| FOREWON | Forces and Weapons System |
| GEN | generation |
| GS | general support |
| H | hours |
| HEL | helicopter |
| HMMWV | high mobility multipurpose wheeled vehicle |
| HRM | hours to perform task |
| HVY | heavy |
| IDEF | deferability |
| IDS | intermediate direct support |
| IGS | intermediate general support |
| IMM | immediately |
| IND | indefinite |
| IPS | Illustrative Planning Scenario |
| IRO | Inventory Research Office |
| JSPD | Joint Strategic Planning Document |
| JSPDSA | Joint Strategic Planning Document Analysis |
| LIN | line item number |

| | |
|---|---|
| LR | logical region |
| LT | light |
| M | mileage |
| MAINT | maintenance |
| MARC | Manpower Requirements Criteria |
| MED | medium |
| MF | masterfile |
| MOS | military occupational specialty |
| MSC | major subordinate command |
| MT CO | maintenance company |
| MT TM | maintenance team |
| MTD | maintenance task distribution |
| NATO | North Atlantic Treaty Organization |
| NEA | Northeast Asia |
| NORTHAG | Northern Army Group |
| NSN | national stock number |
| NUMP | number of people required on task |
| ORG | organizational |
| PCD | program code |
| PLF | projected lifetime failures |
| PLRC | projected lifetime replacement cost |
| POM | Program Objective Memorandum |
| POMCUS | prepositioned materiel configured to unit sets |
| PROG | projected yearly program |
| PWRMS | prepositioned war reserve materiel stock |
| QM CO | quartermaster company |
| R | rounds |

| | |
|---|---|
| RAC | Research Analysis Corporation |
| REPR | replacement factor - percentage of removal components which cannot be repaired |
| SPT | support |
| SRA-96 | Support Force Requirements Analysis - 1996 (study) |
| SRC | standard requirement code |
| SWA | Southwest Asia |
| TAA-96 | Total Army Analysis - 1996 |
| TAC | tactical |
| TOE | table(s) of organization and equipment |
| TACOM | Tank-Automotive Command |
| TRADOC | US Army Training and Doctrine Command |
| TRANSMO | Transportation Model |
| TRK | truck |
| UP | unit price |
| UTIL | utility |
| VEH | vehicle |
| WGT | weight |
| WHL | wheeled |
| WPN | weapon |
| YRS | years of life of end item |

| DESIGN FOR DISCARD (DFD) STUDY | STUDY SUMMARY CAA-SR-89-21 |
|---|---|

**THE REASON FOR PERFORMING THE STUDY** was to determine the impact of the Design for Discard (DFD) concept on the Army's force structure. DFD is an Army initiative to reduce materiel maintenance requirements by focusing on discard of system components in lieu of fault isolation and repair. It is an effort to identify parts which cost more to repair than to replace. The goal is to design or select system components which are easily diagnosed and isolated upon failure and, if possible, inexpensive enough to throw away at failure. The resultant avoidance of maintenance allows personnel spaces to be realigned or converted to other military occupational specialties (MOSs) and applied against force structure shortfalls.

**THE STUDY SPONSOR** was the US Army Materiel Command (AMC), AMCRE-C.

**THE STUDY OBJECTIVE** was to determine the force structure impact of the DFD concept on current Army maintenance support requirements.

**THE SCOPE OF THE STUDY** was as follows:

(1) The DFD Study was based on the Defense Guidance (DG) Illustrative Planning Scenario (IPS) and the 1996 Total Army Analysis (TAA)/Table of Organization and Equipment (TOE) Army.

(2) The study focused on the reparable components of 60 major end items which constitute about 60 percent of the total maintenance workload estimated using Manpower Requirements Criteria (MARC) factors. Currently, MARC factors account for only combat mission essential repairs of equipment, not including any associated with combat damage.

(3) Only those components with maintenance tasks of repair, test, or overhaul at the direct support (DS) and general support (GS) levels were considered.

**THE MAIN ASSUMPTIONS** of this work are:

(1) The sample of major end items used in the study provides a reasonable basis for an estimate of potential force structure savings which accrue from discarding and replacing components due to reliability, availability, and maintainability (RAM) failure in lieu of repair/overhaul of components.

(2) The leader MOS concept used in the Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS) Model for determining maintenance unit requirements still applies.

(3) Failure rates of components in wartime will not vary significantly from peacetime experience.

(4) Estimates used in place of missing data elements were reasonable.

**THE BASIC APPROACHES** used in this study were to:

(1) Include those systems encompassing 60 percent of the DS and GS maintenance workload.

(2) Focus on the component parts of these end items which are currently coded for repair but could become candidates for discard.

(3) Compare these items against criteria developed by the US Army Materiel Systems Analysis Activity (AMSAA).

(4) Apply reductions in workload factors for items meeting the criteria, using the FASTALS Model to determine potential force structure savings. Identify the savings, if any, in terms of military spaces by MOS and standard requirement code (SRC).

**THE PRINCIPAL FINDINGS** of the work reported herein are as follows:

(1) Many components of major end items could be reclassified as discardable items based on the economic methodology used in the study.

(2) Force structure savings based on the labor savings achieved through the use of the DFD concept and applied through the study methodology were negligible.

(3) Further study should be undertaken by the US Army Training and Doctrine Command (TRADOC), possibly to include replacement (versus repair) of components due to combat damage. No significant savings in force structure will be realized through the use of the DFD concept unless the Army's maintenance structure is realigned. Changes in unit design and allocation rules are necessary for the DFD concept to prove effective in reducing required force structure.

**THE STUDY EFFORT** was directed by Ms. Julianne Allison, CSCA-MVD, 295-5225.

**COMMENTS AND QUESTIONS** may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-MV, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

| | | |
|---|---|---|
| CAA | **DESIGN FOR DISCARD (DFD) STUDY** | **STUDY SUMMARY CAA-SR-89-21** |

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**THE STUDY SPONSOR** was the US Army Materiel Command (AMC), AMCRE-C.

**THE STUDY OBJECTIVE** was to determine the force structure impact of the DFD concept on current Army maintenance support requirements.

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**(3)** Only those components with maintenance tasks of repair, test, or overhaul at the direct support (DS) and general support (GS) levels were considered.

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**(2)** The leader MOS concept used in the Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS) Model for determining maintenance unit requirements still applies.

(3) Failure rates of components in wartime will not vary significantly from peacetime experience.

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**COMMENTS AND QUESTIONS** may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-MV, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

| | | |
|---|---|---|
| CAA | DESIGN FOR DISCARD (DFD) STUDY | STUDY SUMMARY CAA-SR-89-21 |

**THE REASON FOR PERFORMING THE STUDY** was to determine the impact of the Design for Discard (DFD) concept on the Army's force structure. DFD is an Army initiative to reduce materiel maintenance requirements by focusing on discard of system components in lieu of fault isolation and repair. It is an effort to identify parts which cost more to repair than to replace. The goal is to design or select system components which are easily diagnosed and isolated upon failure and, if possible, inexpensive enough to throw away at failure. The resultant avoidance of maintenance allows personnel spaces to be realigned or converted to other military occupational specialties (MOSs) and applied against force structure shortfalls.

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**THE STUDY OBJECTIVE** was to determine the force structure impact of the DFD concept on current Army maintenance support requirements.

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(1) The DFD Study was based on the Defense Guidance (DG) Illustrative Planning Scenario (IPS) and the 1996 Total Army Analysis (TAA)/Table of Organization and Equipment (TOE) Army.

(2) The study focused on the reparable components of 60 major end items which constitute about 60 percent of the total maintenance workload estimated using Manpower Requirements Criteria (MARC) factors. Currently, MARC factors account for only combat mission essential repairs of equipment, not including any associated with combat damage.

(3) Only those components with maintenance tasks of repair, test, or overhaul at the direct support (DS) and general support (GS) levels were considered.

**THE MAIN ASSUMPTIONS** of this work are:

(1) The sample of major end items used in the study provides a reasonable basis for an estimate of potential force structure savings which accrue from discarding and replacing components due to reliability, availability, and maintainability (RAM) failure in lieu of repair/overhaul of components.

(2) The leader MOS concept used in the Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS) Model for determining maintenance unit requirements still applies.

(3) Failure rates of components in wartime will not vary significantly from peacetime experience.

(4) Estimates used in place of missing data elements were reasonable.

**THE BASIC APPROACHES** used in this study were to:

(1) Include those systems encompassing 60 percent of the DS and GS maintenance workload.

(2) Focus on the component parts of these end items which are currently coded for repair but could become candidates for discard.

(3) Compare these items against criteria developed by the US Army Materiel Systems Analysis Activity (AMSAA).

(4) Apply reductions in workload factors for items meeting the criteria, using the FASTALS Model to determine potential force structure savings. Identify the savings, if any, in terms of military spaces by MOS and standard requirement code (SRC).

**THE PRINCIPAL FINDINGS** of the work reported herein are as follows:

(1) Many components of major end items could be reclassified as discardable items based on the economic methodology used in the study.

(2) Force structure savings based on the labor savings achieved through the use of the DFD concept and applied through the study methodology were negligible.

(3) Further study should be undertaken by the US Army Training and Doctrine Command (TRADOC), possibly to include replacement (versus repair) of components due to combat damage. No significant savings in force structure will be realized through the use of the DFD concept unless the Army's maintenance structure is realigned. Changes in unit design and allocation rules are necessary for the DFD concept to prove effective in reducing required force structure.

**THE STUDY EFFORT** was directed by Ms. Julianne Allison, CSCA-MVD, 295-5225.

**COMMENTS AND QUESTIONS** may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-MV, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.